



“ Once agreed on the scientific part, we should apply the method we found the best as we did for the analysis of the beets, without bothering about selfish outcry wherever it comes from. We must do our duty as chemists and we must not have a method imposed neither for sugar nor for other products. Let us work out a practical method, let us follow it and the present disagreements will disappear forever ”

This is what Chemical engineer August Aulard proclaimed at one of the meetings of the Belgian Association of Chemistry (Association Belge des Chimistes) at the end of the nineteenth century...

Today, after a little more of one century, both the Union of the growers and the sugar manufacturers would smile about this naivety ! They know that scientific expertise is not sufficient in order to establish a “good” chemical protocol for contractual purposes.

The aim of my presentation concerns the implication of a scientific instrument inside an industrial context of usage. The latter take the forms of various little laboratories situated in the Belgian country-side. More precisely, those laboratories are generally situated in the area surrounding fields and have the objective to evaluate the weight and the content of sugar of the beet deliveries ; and this for contractual

purposes. The beet testing laboratories constitute a social and technical mediator by which a mode of coordination is temporarily crafted between two groups of actors : the growers and the sugar manufacturers.

What is skillfully, patiently and in a contradictory way build up, there, is a representation of what a sugar-beet is, as well as a representation of what a beet grower and a sugar manufacturer are.

The viewpoint adopted in this work consists in wondering which ties these two actors may weave when they have chosen to coordinate one another on the basis of the handling of a measuring instrument which...., with practice, turns out to be itself relatively imprecise and inaccurate ; its object being to determine as right as possible the financial quality of sugar beet deliveries. The main characteristic of this coordination is without doubt to be practised in a contradictory way by the shared use of a same technical equipment.

A place...



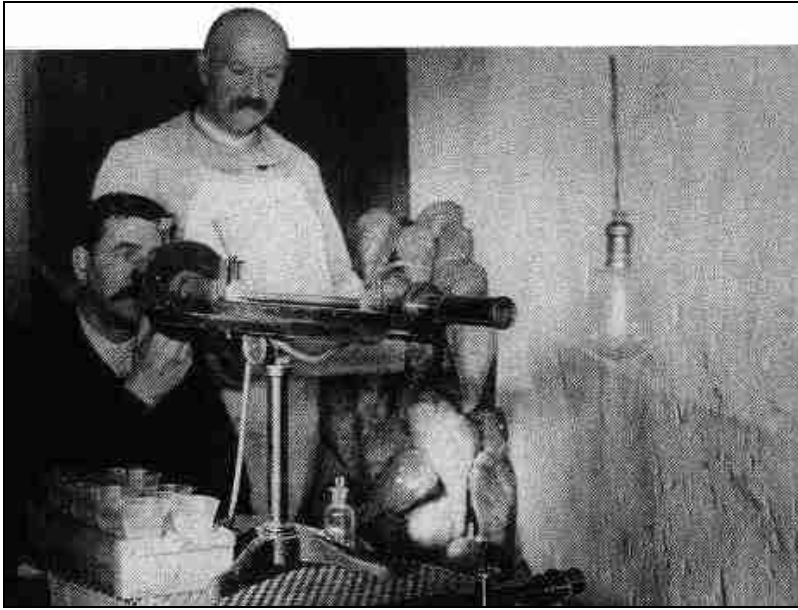
The particular setting I want to introduce to you comes from my ethnographic work in laboratories... and more precisely in laboratories situated in the Belgian countryside.

As a matter of fact, this laboratory is rather different from other industrial settings: instead of just being a private place for secret industrial practices, the beet testing laboratory is widely open to public scrutiny. The reason for this is, of course, linked to its basic function : that is to say to produce technical and quantitative evidence of the financial value of raw materials. To manufacture white sugar, it is necessary to buy raw materials from which it is easy to extract saccharose at little cost. So, the beet testing laboratory becomes the technical mediator through which principles of payment for beet delivery will be worked out. One of these principles mainly deals with the “**objective**” determination of the saccharose content in sugar beets.

In contrast to what is usually going on in the execution of experiments in scientific laboratories, the beet reception laboratory is configured around the « public » production of tests on beet samples. Public here means that all the different operations are carefully monitored by both parties and this nearly in real time. This is said to be done “contradictorily”... Each samples analysed through the device (dispositif...) may be subjected to a counter-analysis.

Why does this apparatus remain in use after such a long time and above all after so many technical controversies surrounding its working ? How to explain the deep involment of the operators (of both parts) which may occur in the use of their instruments ? Those two questions aim at introducing this strange correspondance between the constitution of a technical protocol and the production of identities...

A sociology of metrological practices : To be through a metrological process



To be in relation with others may be assessed through the metrological dimension of their coordination. In the present case, the identity of beings (human and non-human) is never given... it is constituted through a process of coordination involving instruments, materials, protocols and skills. We are through the materials, the methods, the instrument we choose or are constrained to use in relation to others. In fact, it is misleading to situate oneself or the others completely inside this dichotomy of liberty/constraint... More often than not we enter a world which already implies the living with some substances or instruments. The case of the beet reception in field laboratories is quite revealing in that respect.

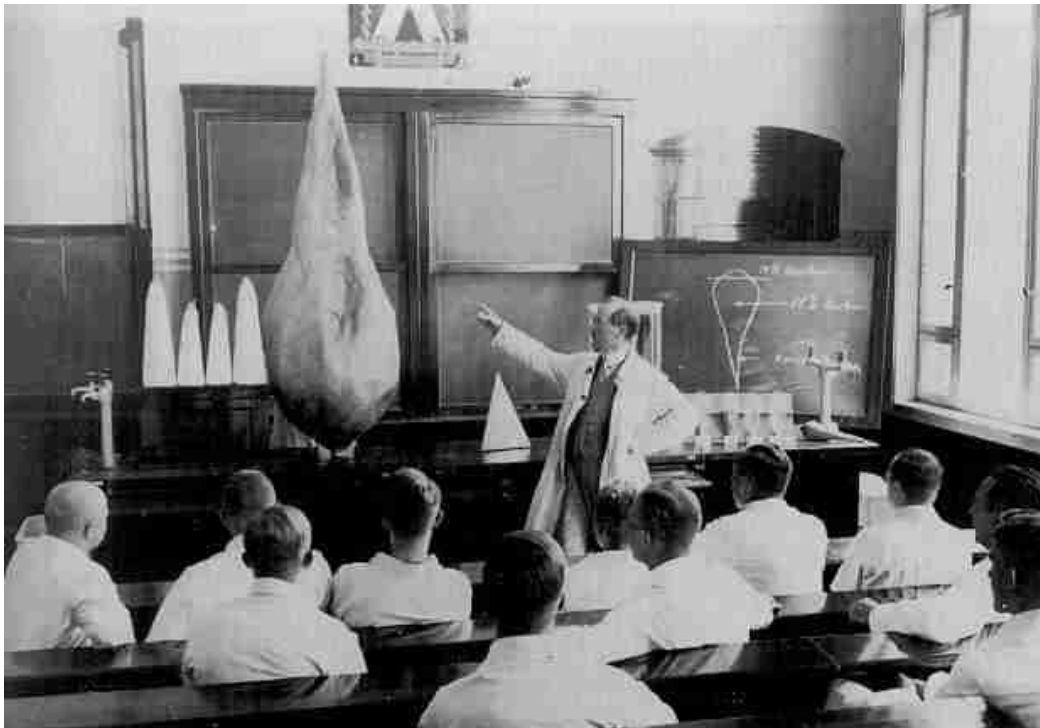
What means « to be » in the laboratory is not directly related to big entities like institutions, positions in the social structure, and so on... In this sens, my speech will depart from the usual sociological standpoint according to which "Status" or "Roles" are the key concepts in order to describe and explain the identity of those actors... Following what has been suggested by my fieldwork, the presence and its nature of the different actors inside the laboratory (including the sugar beet) is much more related to different understandings that each delegates (engineers of the sugar house and controllers working for the sugar-beet producers) may have regarding to the several parts of the protocol of analysis of the samples.

This is why we will have to go briefly in the technical points in order to see the sociological argument...

I chose the Belgian context for two reasons : I'm Belgian and, secondly, it was in Belgium that the use of the polariscope was extended for the first time to the contractual assessment of the sugar content of the sugar beet deliveries.

There is an historical constatation : the sugar-beet as an industrial crop was born nearly simultaneously with the instrument – the polariscope - which qualifies its main characteristic : that's to say its sugar content.

The way sugar-beet has been engaged in the network of the production and marketing of sugar is fascinating...

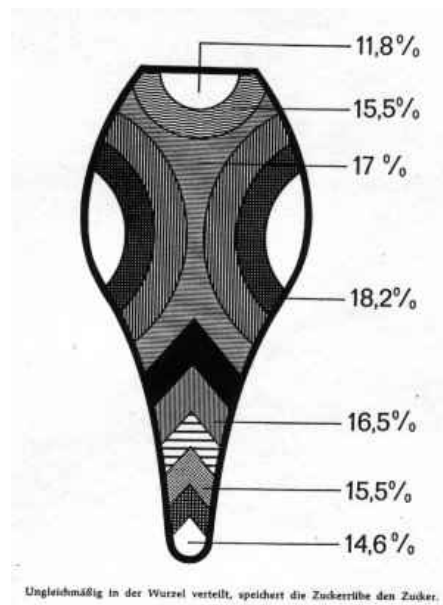


I received a gift from my fieldwork : This is this interesting coincidence that the first scientific association of chemistry in Belgium was created in 1887 precisely in

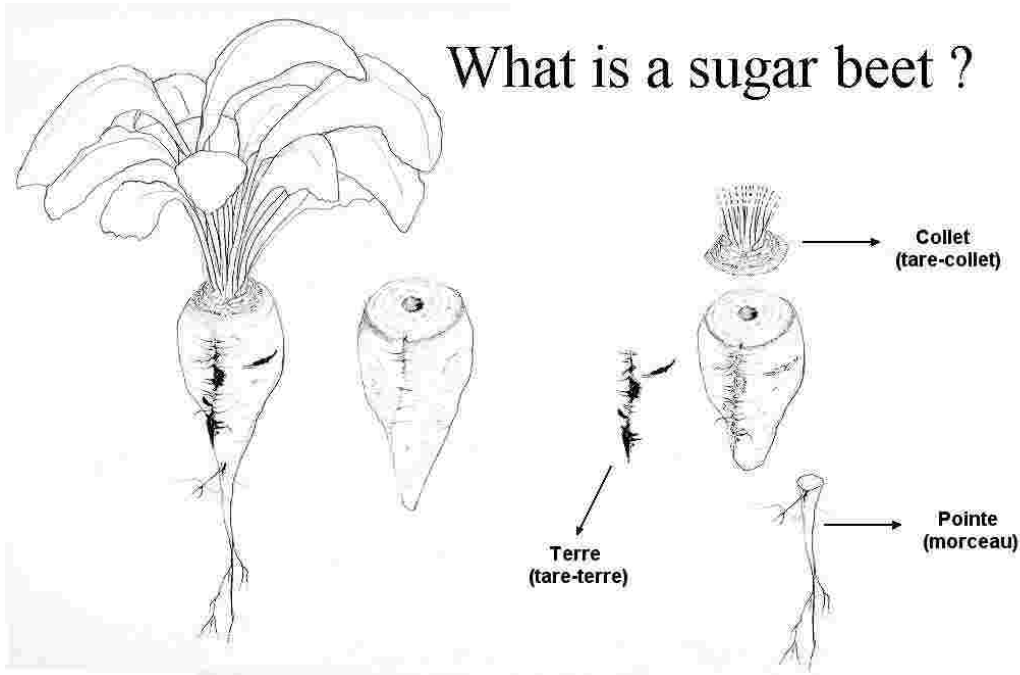
order to resolve this controversy about the chemical evaluation of the sugar-beet deliveries ! And this in order to put some “objectivity” in the analysis of the samples.

At the end of 19th century, a lot of studies designed in the form of experiments (control of variables, elaboration of protocols, systematic gathering of results and displays in graphical and statistical ways,...) were usually carried out inside the laboratories of the sugar houses... Their results were discussed, compared between chemical engineers employed by those sugar houses and published through the professional review of the Belgian Sugar Manufacturers Association (l'Association des Fabricants de Sucre de Belgique).

Quite quickly, questions like what is the **content** of sugar present in the root, what is its **distribution** inside its body ? were tremendously important to optimise the production of sugar and to define what an ideal, contractual sugar-beet should be....



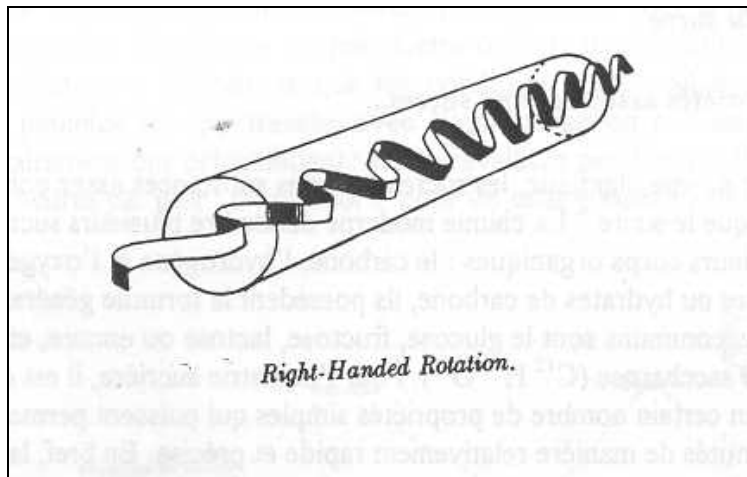
Those experiments will enable the mapping of the root and give birth to a new kind of Sugar-beet. A sugar-beet that will be defined differently from that of the beet growers...



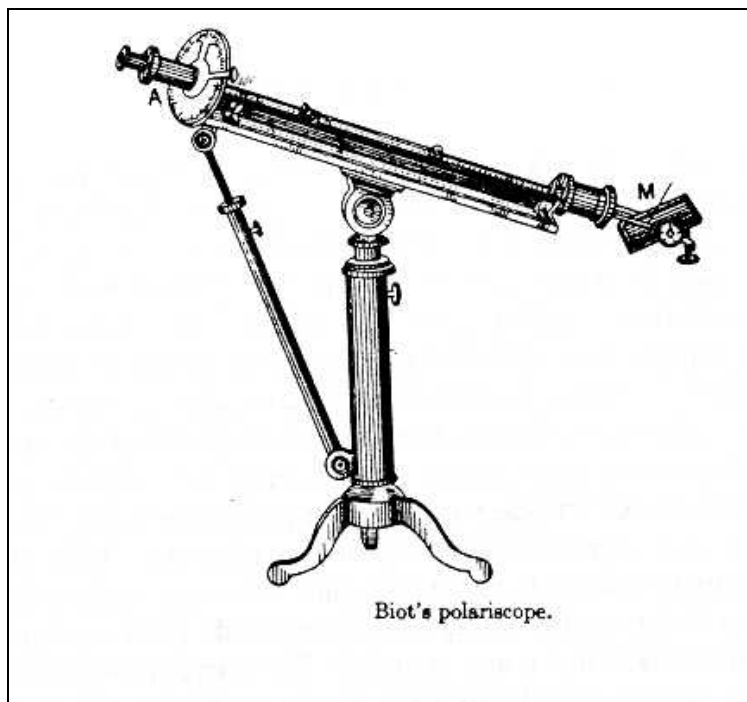
Polarimetry and its affordances...

Polarimetry or even saccharimetry don't mean anything in themselves... one has to catch their properties when they are applied in definite, local situations... Polarimetry and saccharimetry are methods used in a high variety of cases involving quite different purposes (ex : in medicine with the assessment of the sugar content in blood, in Crystallography, in Chemistry or in Physics, ...). But what does it mean to... « *exercice-polarimetry-inside-the-beet-reception-laboratory-for-the-assesement-of-the-sugar-content-of-sugar-beet-for-contractual-purposes* ». It is along this long chain of words, this long sentence that reside the possible affordances of the polarimetric method in my case study.

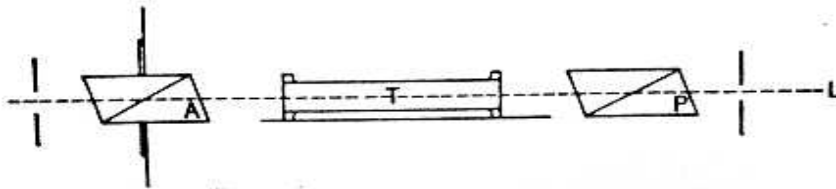
Without entering in the details of the physical and chemical characteristics of polarisation, the process by which a polarimetric lecture of the content of a sugar solution is done is quite easy to understand. The polariscope in itself is a quite easy apparatus to grasp...



A Sugar solution has the property of twisting the plan of rotation of a ray of polarised light. This is done in the exact proportion of the sugar content of the solution... It was in Belgium at the end of 19th century that this « property » of the sugar solution was used for the first time for the determination of the sugar content of deliveries in sugar houses.



The french physicist Biot designed in 1840 a quite simple apparatus – called un polarimètre : a polariscope or polarimeter - to make this rotation visible. Still now polariscopes despite their better precision and their automation don't depart themselves from their early ancestors... They are usually made of three parts : a polariser prism, a tube filled in with a sugar solution and an analyser prism...



Showing arrangement of parts in a simple polariscope.

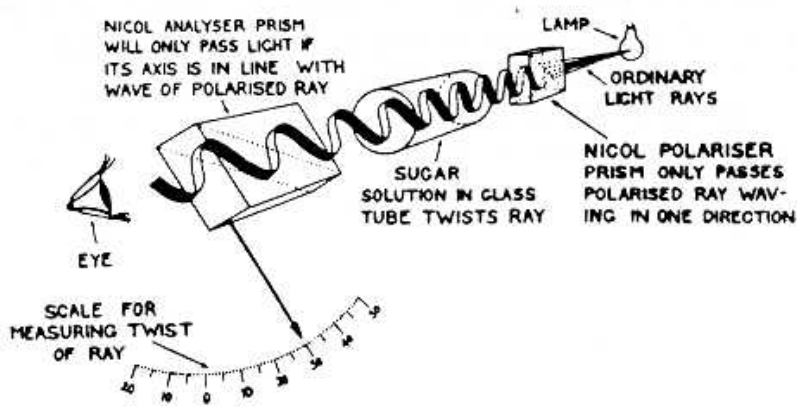
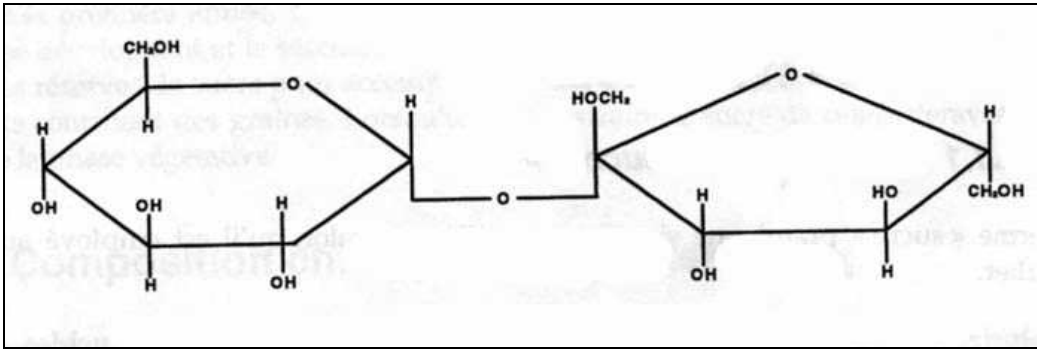


Diagram of the Principle of the Polariscopes.

This technical way to assess the content of sugar is more than a century old... but vulnerable and liable to a lot of controversies between sugar manufacturers and sugar beet growers about the way to interpret the results... Especially on the way sugar react to some substances and is being made visible by the polarimetrical lecture.



Indeed, Sugar « in general » is made of different types of sugars : Saccharose (the most important for the production of crystallized sugar), but also Raffinose, fructose, glucose... Those sugars unfortunately impede the correct and easy crystallisation of saccharose and have to be reduced during the process of extraction. The sugar solution as it is extracted from the sugar beet by the laboratory contains, apart from saccharose, some of those different sugars (which are called in the vocabulary of the sugar chemists : « nonsugars » or « inverted sugars »).

The incertitude surrounding the polarimetric lecture lies in the fact...

....that if saccharose twists the plan of rotation of the polarized light at the right side (which is called a Right-Handed Rotation) as does the dextrose sugar, others like fructose or glucose are levogyre that's to say that the rotation goes left...

The polariscope which is quite easy, quick and reliable in its use is definitely **blind** to those differences... Indeed, the result it gives in terms of percentage of sugar is a sum of all the combined effects of all the different sugars present in the sugar solution. In other words, it records the result of the compensation between the effects of levogyre and dextrogyre sugars....

For sugar manufacturers, this is a problem because the content of sugar contractually paid to the growers is a « sugar-as-it-is-polarized » and the quantity of sugar assessed by the instrument may be –unfortunately for them - over-estimated because of the effect of dextrogyre nonsugars or the dextrogyre effects of some amino-acids... Moreover, it is important to ensure the quality of the sugar-beets by

reducing the quantity of non-sugars to improve the process of fabrication and thus to reduce the cost of production of crystallized sugar.

On the side of the growers, as they are paid according to the sugar richness of their sugar-beet deliveries, the correct, objective determination of the sugar content is very important...

What sugar means or what a sugar-beet means is quite different according to a sugar manufacturer or according to a sugar-beet producer. This is particularly visible (obvious) when both parties have to agree on a national chemical protocol to be applied in all sugar houses.

Despite those perpetual conflicts about the correct assessment of the sugar content and about the way to perform polarimetry, this method and apparatus remain a standard and are even imposed inside each country and more generally inside all the European Union...

A ready-made account is usually given by some actors : "This industrial sector is really conservative !". But this is a kind of social explanation a bit too hastily used.

According to some interviews and observations carried out on the subject, it appears that it was not a problem of resistance to innovation *per se* but surely a problem of imputation of identity between both parties inside the laboratory...

Indeed, when actors discuss about the working of their apparatus or about the method used, they are discussing simultaneously about themselves...

After more than one century of coexistence *about* the utilization of the polarimetric method, each group of actors (chemical engineers of the sugar house and chemical controllers/inspectors of the grower's Union) are knowing each other very very well and this according to the way they take position themselves inside the practical contingencies of the working of the polarimetric method and of the practical usage of the polariscope. Each actor knows where he can take advantage on the other by playing on several specific technical devices of the apparatus... to under or over evaluate the sugar content of the deliveries.

What is the sociological or anthropological issue here is the connection between the identity of the operators and the identity of the sugar beet. Just saying that it's just a problem of an arbitrarial correspondence between an identity and a usage is reductional...

Here identities are not self evident even in the side of the polarimetric protocol... The identity of humans and non-humans are under-determined in the sense that they correspond to a temporary undercapture... The identity, as we will perhaps have not enough time to discuss, is a minimum : it doesn't sum up each participant, it just point to one of their numerous possible facets or types of existence.

As Gabriel Tarde – a French sociologist who was in fight a century ago against Durkheim about the way to describe social action – would say there is a kind of unique **exchange of properties** between human actors and non-human entities.

Exchange of properties...

From the perspective of the « Sugar in general »: by the polarisation's capability of the sugar solution, a property of visualisation is transmitted to social actors. For them, the representation of what the volume of sugar in the sugar-beet means, is vehiculated by the graphical representation of the twisted propagation of a ray of light... They all have in mind this image when they speak of what's going on during the assesement of sugar. This representation is attached to the technical means (the polariscope) by which results are produced.

Moreover, the recalcitrance of the nonsugars to behave differently (that's to say their capability to behave in some respects differently to what is expected) and their variable content according to the substances that are added to or removed from the sugar solution tested... enables distinct points of view on what sugar is. Indeed, one can not make the sugar beet do what one wants. The actors are aware of this and they play actively on those constraints and affordances. These affordances do never appear as such but are always anticipated, related, experienced, visualised, etc. In this way, it is possible to depict the « reality » of a natural resource (the beet, the sugar) not by postulating it a priori, using good sense or relying on the disciplinary science which is linked to it, but by seeing what it makes the actors do, and how the

latter speak, discuss about it or confront each other. In this way, the beet is a battle field : its geography is being fought between its most essential parts and the less liable to enhanced value.

Reciprocally, chemical engineers according to the institution they belong to give voice to what's happening when some elements of the chemical protocol are modified.

Commentaire [FM1] : Ne pas utiliser cette manière structuraliste de décrire les relations

Indeed, each chemist according to his institutional membership (the sugar house or the Confédération Belges des Betteraviers = the Belgian Beet Growers' Confederation) links himself to certain substances he wishes to add to or remove from of the protocol about the testing process.

Commentaire [FM2] : idem

The identity of the chemical experts is related to which substances they choose to enroll to speak about what's going on when sugar is polarized. **Each party leans on effects produced by the matter referred to within the protocol.**

The sociological result of those exchange of properties lies in the fact that both human actors and the sugar-beet gain some new properties that matter for their association. The sugar beet "enriched" with this polarisation's capability of its sugars makes it be different for the social actors. Reciprocally, the following ones, by designing a new technical device that reveal this new property associated to the sugar beet, modify what counts as important in their way to relate to ones another.

Those exchanges of properties has to be intellectually assimilated to an exchange of affordances between sugar polarisation's characteristics and social actors capabilities to give voice to those characteristics according to their particular involvement in the sugar-beet industrial testing process.

According to that reasoning, the sugar beet is (sociologically) different according to the way you decide to link to it, the polariscope is (sociologically) different according to the way you decide to link to it, because each time they make a difference for social action in its own way.

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