The Analysis of Practices

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TABLE OF CONTENTS

SYNOPSIS

Practices are ubiquitous in various versions of human life, whether social as in the lives of families, teams, and so on or solitary as in the lives of hermits such as the Desert Fathers. There are ways of doing things, that are the settled and often unchallenged patterns of human action. How should we analyse practices to understand them? What repertoire of concepts do we need to use to this end? We propose the following to shape our enquiries: presuppositions in the form of Wittgenstein's *hinges*; *affordances* on the model of J. J. Gibson's understanding of perception; causality as *agency*, both natural and human; entities and the *mereological* rules for considering them; *fungibles* as perfectly identical beings which mark the boundary between theory and observation and practice; *models* making use of fungibles as the idealised content of explanations.

The use of these concepts in analyses of practices and procedures displays the steps by which they make practices intelligible and defensible. After illustrating the analytical method in some simple examples, we proceed chapter by chapter to introduce the uses of these concepts as one by one they reveal successively the content of two practices we use as exemplars in each of the chapters. We analyse the conceptual structure of blood-letting as a medical practice and of trial by jury as a legal practice. From time to time we introduce additional examples, and in the last chapter work through a variety of case studies displaying the power of our procedure.

ACKNOWLEDGEMENTS

CHAPTER ONE

THE CONCEPTS OF "PRACTICE" AND "PRAXIS"

There are many kinds of orderly behaviour in human societies. We single out some as practices, similar patterns of behaviour directed towards securing some end. Customs and social habits are practices often taken to be characteristic of cultures. Scientific research activities and their reporting are practices characteristic of specific sciences. In the course of these studies we hope to arrive at a crisper differentiation of the conceptual varieties of activities we call "practice".

The very idea of a "practice" has a number of aspects. Whether these aspects are linked conceptually or empirically is a matter for discussion. For example, does the concept of "practice" necessarily include causation? Must it be an activity undertaken by more than one person? Implicitly or explicitly a practice has one or more products taken as ends in view, though practices differ in the extent to which these ends are consciously attended to. A practice involves standards of good work, often set by an institution. Michael Polanyi (1955) pointed out that every implementation of a practice, successful or unsuccessful, depends on a tacit dimension of skills and knowledge usually held to without specific examination or assessment of any of its constituents by skilful practitioners.

In any culture there are larger and smaller conglomerations of practices. For example, the epistemic profile of chemistry is shaped by various fields, academic and industrial — ranging from medicine and pharmaceutical companies to nuclear technology, biotechnology and nanotechnology, organic and inorganic chemistry, green and sustainable processes, quantum modelling, catalysis, electrochemistry and soft chemistry, to quote but a few instances —, each domain having its own background with its own aims, representations, know-how, problems to solve, ways of doing, and resources. If we take chemistry to be a "repertoire of practices embedded in a matrix of theories", it is on a far grander scale than the practice among a small minority of families of shedding one's shoes at the door. Some families do this, some don't. Those who do engage in this

practice usually have theories about tramping in dirt. The Japanese practice of shedding shoes upon entering a sacred space is to do with sanctity rather than hygiene. These larger and smaller groups of practices can usefully be seen as forming hierarchies. For example, the practice of medicine covers a very wide range of procedures, such as the practice of anaesthesia, the practice of skin grafting, or the practice of bloodletting. Some of these practices are current, while others are obsolete or extinct. The practice of warfare encompasses the practice of bayonet charging and the practice of ransoming fallen knights. Again, some practices of warfare are current and some are extinct.

In several recent publications in the philosophy of chemistry (for example Harré & Llored, 2011, 2013) we have made use of a novel conceptual repertoire for assessing the intelligibility of a discourse and the trustworthiness of associated practices. In the following discussion we explore the possibility of using this repertoire as a methodology for studying and evaluating any human enterprise in which implicit propositions and skilful practices are *intimately interwoven* in the work of some profession. We believe that it is part of a larger framework, common to the understanding of investigations of both cultural and natural phenomena. None of the concepts deployed in the proposed methodology is original, but we believe the use of this repertoire in a coherent analytical practice is enlightening. It sets a standard by which evaluations of practices could be judged. Throughout this study we follow British grammar by distinguishing "practice", a noun, from "practise" a verb. One practises an activity as a way of achieving a certain aim. The activity one carries out is a practice.

In assessing the worthiness of a practice, efficacy in achieving the aim of a performance is relevant but not at any cost. Human value is also an obvious basis for criteria of reflection on the quality of practising a certain activity, say watering the garden during a drought. It is good for the plants but may be bad for the national water supplies.

We can ask of a practice whether it is efficacious and morally worthy, efficacious and morally obnoxious, morally worthy and ineffective, morally obnoxious and ineffective. In real cases each of these defining concepts comes *in degrees*.

We will develop an analytical tool by making use of Wittgenstein's insights in *On Certainty,* as refined and elaborated by Daniele Moyal-Sharrock (2004). Wittgenstein singles out certain propositions that express

untested and usually hitherto unexpressed beliefs about the world and the people in it and how to proceed through life successfully according to some criterion of quality. He calls these "hinge propositions". They remain the same while our everyday activities change, just as the hinge does not move when the door swings.

In *On Certainty* Wittgenstein's examples of hinge-propositions, and those like them in the way they work, express unexamined empirical beliefs. But they do not function as empirical propositions. Reflection on hinge-propositions could be taken as a pattern for revealing some of the tacit knowledge of skilled actors and associated hinge-practices. Surgeons have vast stores of tacit knowledge of correct, that is efficacious, procedures in various circumstances, more easily demonstrated than described, taking for granted their rights and duties as surgeons. It is only when something goes wrong, that is not in accord with how things are done, or how far surgery should be expected to be effective, that moral questions arise. Or when what is being skilfully done is embedded in a larger context. Holocaust doctors were also doctors. No doubt they treated the families of the guards for minor ailments. Wittgenstein's hinges should be given a moral dimension if our analysis is intended to effectively analyse how ordinary life is managed. Practices ought to be judged not only in accordance with criteria of efficacy but also propriety, decency, avoidance of pain, human dignity, and many other morally relevant aspects of practices, elaborating on our basic suggestion of four pairs of evaluative concepts.

This aspect of the management of human action was expressed by Marx, in *Theses on Feuerbach* (Marx, 1845). He contrasts explaining the efficacy of practices (for example medicines by biochemistry and bacteriology) with using this level of explanation as a grounding for moral and political change. Traditionally practice has been contrasted with theory. The theory of cheese making is one thing, but the practice of serving cheese in relation to wines is independent of organic chemistry. Cheese making cannot be fully understood unless the practical sciences of dairy management and how to prosper in the market place are used to complete one's understanding. The practice of labelling cheeses with their place of origin is a moral protection. Dishonestly misusing it is a crime in many places.

Some Relevant Concepts

In this presentation we show how the concepts of a Gibsonian *affordance* and of a Wittgensteinian *hinge* can be linked to some other concepts either newly revived or newly created in recent philosophy. These include: (1) the treatment of properties as *dispositions*; (2) the distinction between the *Welt*, the world "in general" that is the raw environmental given to a species which von Uexküll called *Umgebung*, and the *Umwelt*, the world that is perceived and interpreted by each species of living being, including humans, and which is related to the idea of the "mutual fitting" between the considered species and its proper environment (von Uexküll, 1934); and (3) *the first and second mereological fallacies*, mistakes in making inferences from knowledge of parts to claims about wholes and vice versa. To complete the analytical resource we are advocating, we need *causation* as the exercise of *agency*, and explanation by the use of *iconic models*. A boundary between empirical and formal models can be sharply defined by the identification of *fungibles,* that is perfectly identical entities distinguished from other kinds of individuals and attributes, which are alike for all practical purposes. All in all, this will give us a cluster of concepts with which to examine the place of knowledge of social orders and of mechanical engineering, chemistry and other sciences in the study of the conceptual foundations of a wide variety of practices.

Perhaps studies of other sophisticated knowledge garnering practices such as police investigations or translating ancient texts, could benefit from adopting this analytical scheme if we want to understand their merits and drawbacks. Our suggestions for shaping methodologies for philosophical studies in particular fields of interest include both the natural sciences as practices, legal systems in action, economies and their management, warfare, preparing the dishes of a cuisine, and so on. Adopting our proposals would encourage philosophers to examine our world seen as fields of material and cultural/social entities affording opportunities for action. At a certain level of analysis, the products of such action, appear to be perfectly identical entities, fungibles. There are no fungibles in nature. They must therefore be thought of as constituents of iconic models. Our scheme for critically examining the practices of investigators is meant to ensure the intelligibility both of the relevant discourse and the trustworthiness of the practices of the discipline in question. The third Wittgenstein's "hinges" that function as necessities and yet are vulnerable to empirical assessment provide a generic frame for analyses of human practices.

We will trace the transition of the focus of analysis through the leading concepts in our scheme illustrating the transition from hinges to causality to affordances to the resolutions of mereological fallacies, which leads us to the construction of models distinguished into realistic and pragmatic by reference to the emergence of fungibles in the working metaphysics of a discipline.

To carry through this programme, we will illustrate each transition by following it in the case of two historical examples treated in some depth. In one, the medical *practice* of bloodletting for reducing fevers, the analysis will reveal the fallacious reasoning involved in maintaining the practice. In the other, the legal practice of trial by jury, the analysis will display the reasons for continuing to decide criminal cases in this time-honoured manner. In each example we will build on an outline of the history of the practice elaborating it as we display the illumination our repertoire of analytical concepts brings to the value of the practice. Many other smaller scale examples will be sketched as appropriate in the course of this study.

Contemporary meanings of the words "practise" and "practice"

The general idea of a *practice* seems to be a human activity managed according to principles or rules undertaken with an end in view and with agreed standards of "good work". There is an activity and an available discourse relevant to that activity. There may be any number of people involved from just one up to hordes. There is self-management, team management and crowd management.

It may be illuminating to consult the dictionary. "Practice" is a word with two main meanings.

It is used to describe repetitions of procedures requiring adherence to standards of correctness which may or may not have any outcome other than error free and consistently similar performances. For example, a concert pianist practises the piano and a forger practises a signature not his own. In this use "practice" is morally and politically indifferent. What we practise could be admirable or contemptible depending on such matters as the intentions of the actor and the situation. The point of this kind of practice is the benefit of the actor or actors.

The root notion of a practice does not include, though it does not exclude the moral aspects of performing a routine which we are completing in accordance with local standards of correct procedure.

The second main meaning is exemplified in examples like "a medical practice", "a legal practice" or a "sharp practice", where the phrase usually refers to performances in a small-scale institution. A practice is made up of procedures that adhere to an ideal type. Unlike repetitive training a practice frequently invokes or presumes standards of correct procedure, and so is to some extent concerned with normative criteria. These may be pragmatic, moral or even political. In both uses critical commentary is appropriate for both procedures and outcomes. This presupposes that routines may change with respect to an existing ideal, finding better routines to realise it. But revising routines may realise a different outcome as the point of the procedure. A farmer starts off to drain a swamp, but using the same techniques, constructs a wild life pond instead.

The moral content of practices

The path we are pursuing in these studies is aimed in part at adding substantial content to Aristotle's well-known catalogue of kinds of knowledge, opinion and belief. In his *Nicomachean Ethics*, and especially in the Sixth Book, Aristotle first deals with the knowledge of things whose originative causes are invariable – the principles of scientific knowledge, or *epistēmē* –, and focuses his attention on the fact that invariable causes can be replicated under similar circumstances, i.e., satisfy the requirements of scientific stability and universality. He then points out how the knowledge that guides art and action differs from *epistēmē*. To do so, he refers to situations within which human beings have to make a decision when the causes are not stable and universal, but, are, by contrast, context-dependent and never fully known – as is typically the case with chemicals the reactivity and the toxicity of which depend on what surrounds them –. Aristotle calls *phronēsis* the special type of wisdom relevant to a practical decision of this kind (Dunne, 1993; Birkholm, 2016). This wisdom requires an ability to discern the opportune moment to act, i.e., the *kairos* in Aristotle's terminology, and why one may act despite the indeterminacy of the situation. *Phronēsis* is thus related to decision-making and action in cases of indeterminacy and uncertainty. In the *Nichomachean Ethics* Aristotle thus distinguishes between *epistēmē*, that which is certainly true, *techné*, knowing how to create something, a skilled craft, and *phronēsis,* usually translated as practical wisdom or prudence. The personal attributes

of someone who has mastered a practice in the sense we are using the word are primarily *phronēsis*. It is a distinctive virtue. In *Nichomachean Ethics* 1140b Aristotle remarks that practical wisdom cannot be knowledge or art, because what falls under the province of doing must be contingent (whatever is made could have been different), and the latter because "doing and making are different in kind". "Making aims at an end distinct from the act of making whereas in doing the end cannot be other than the act itself".

Aristotle does not offer any details of what a phronetic corpus would include. Expressed in these terms our project is to fill out the content of *phronēsis* for those human practices where practical wisdom is a prerequisite for the successful accomplishment of a project, be it a tennis match, a manipulation of carbon nanotubes, a heart transplant, a visit to the hairdressers, a parliamentary vote, and so on. At every point along the way, from the point of view of the human actors, contingency reigns. Expertise is not enough. The outcome of carrying out a practice will either confirm what people do or sometimes make a difference to the lives of the people involved. Whether or not this happens seems to depend on factors *external to* the performance aspects of a practice. For example, corporal punishment in schools, a practice now largely abandoned in favour of other forms of punishment for misdemeanours, once treated as a badge of honour by those on whom it was inflicted, is now regarded as a violation of human rights, an aspect of a larger social transformation rather than changing disciplinary practices in schools.

Recently a distinction between regular procedures without explicit normative content and those with moral or political significance has been marked by using "practice" as the generic concept and "praxis" for morally and politically significant procedures. Changing a procedure may make a difference to people's lives. We note that a changed procedure is effectively a new procedure likely to influence a myriad of other matters as it is implemented. Abandoning the practice of killing people who committed heinous crimes required revised practices throughout the legal system and not just on its moral aspects. This raises the question of how to individuate *a* procedure. The phronetic content of practical wisdom in a certain context might consist of rules for repeating procedures and specifying desirable outcomes.

Smith (1991, 2011) remarks that many authors who are involved with "acts that shape and change the world", rarely use "praxis" to make an explicit distinction between "practice" as a means for achieving an

outcome and "praxis", as informed committed action (Smith, 1999, 2011). So the implication of this remark is that "theory" should stand over against two types of practical procedures. There are those, the specification of which is exhausted by the requirements for a material or cognitive procedure, such as sawing wood accurately or performing simple arithmetical operations, to be called "practices", and those which stand over against procedures that are informed *by aesthetic, moral or political aims*, "praxis". The literature cited by Smith is largely devoted to exploring various educational practices considered as "praxis". Seeing education as praxis contrasts with justifying it as a practice with such remarks as "it keeps the kids off the street".

We need all three concepts to make sense of social action considered as "practice" including the contemporary use of "praxis" that Aristotle used to refer to those regular procedures that are directed towards a desirable outcome. In the *Nichomachean Ethics* the worthy man can do no other. Aristotle strengthened this distinction using the notion of *poiésis*, which is different from that of *praxis*. *Poiésis* encompasses art, technology, and the activity of production in the broadest sense of the term. It is related to the means we use in order to satisfy our needs and desires, independently of any moral reflection about the possible bad consequences that this use of means may have upon other people. To make this idea more concrete in the domain of chemistry, *poiésis* could be related to the production of chemicals in order to satisfy our need for transportation, independently of the consideration of both the bad health and environmental impacts of gasoline. That is the reason why, according to Aristotle, *poiésis* should be complemented with *praxis*, which is about the capacity we have, as human beings, to explore with caution not only ourselves, but also the city we live in. *Praxis* is thus related to political action within a particular community, and *phronēsis* means to take care both of ourselves and the *polis* – the city state in ancient Greece. In our time we need a word for those actions that are merely directed towards some outcome, that is not random. Some will be worthy, some indifferent and some undesirable.

We can illustrate how this distinction works in real cases of planning and carrying out chemical research. To do so, we will first refer to "phlogiston" in the 18th century in order to illustrate the notion of practice, and then to current green chemistry in order to illustrate the notion of *praxis*.

One of the ways the distinctiveness of a culture is revealed lies in the range of kinds of beings that are taken for granted to exist. Negative

existential statements cannot be proved but the plausibility of a domain of invisible beings can leak away and the force of a culture it sustains diminishes with it, as it was gradually the case for "phlogiston" in order to explain combustion from Stahl to Lavoisier. For Stahl (1659–1734), a leading chemist of the eighteenth century, the characteristic of chemistry is the "mixt," which was distinguishable from mere aggregations of bodies, and their analysis is the entire task of the chemist alone (Principe, 2007). Fire put the "phlogiston" in motion, air blew off the most volatile part of bodies, and water put the parts into solvated motion. Fire was the instrument, and the phlogiston was the element entering into the composition of the "mixts." It explained combustion as well as the transformation of the "calx" into metal and, vice versa (that is, metal = calx + phlogiston). The "phlogistic theory" was very much contributory to the better understanding of early views of energy conservation and it also served as a heuristic tool to stimulate a vast amount of experimental research. The downfall of this "invisible being" was caused by the observed fact that products of combustion retained a greater weight (mass) than the combustible substance from which they were derived. Notwithstanding, with the ingenious attempt to explain this phenomenon by assuming that phlogiston possessed a negative weight, the idea of phlogiston did not resist later rational protests. New apparatus enabled Lavoisier (1743–1794), and many chemists around him, to presuppose another invisible being, the "caloric," in order to explain combustion, thus paving the way for a new culture for chemists based on quantitative analysis of bodies and on a new way of naming those bodies (Holmes & Levere, 2000). Be it in a realistic manner or pragmatically, a culture cannot but presuppose kinds of beings which contribute to shape the way pieces of apparatus are constructed and the way experiments are carried out. Conversely, ways of doing experiments using such apparatus, methods, skills, and devices take part in both the stabilization and the constitution of *what* scientists investigate. The epistemological shift from phlogiston to caloric depends on factors *internal to* the performance aspects of the whole procedure of gas identification and cannot be detached from the increase of the explanatory, predictive and heuristic power it makes possible for chemists to implement. This is practice.

The situation is different when we consider a current change in chemistry, namely the emergence of green chemistry. By definition, "green chemistry" encompasses the design, development, and implementation of chemical products and processes to reduce or eliminate the use of substances hazardous to human health and the environment. Green chemistry is introduced as a branch of the public services in charge of

taking care of both natural resources and life on earth. In a seminal paper entitled "Green chemistry: today (and tomorrow)" dealing with the "key drivers" for major chemical changes, the chemist James Clark, a leading expert in the field, highlights the reasons why and how chemists are transforming the way they practise chemistry (Clark, 2006). In this respect, he identifies three main drivers for change. The economic driver which mainly focuses on the increasing costs of waste disposal or for storing hazardous substances. This driver is also related to energy and petrochemical expenses and the increasing fines for pollution. The societal driver is mostly concerned with the increasing demands of emerging nations, local and global problems of demography, the poor public image of chemistry and the negative media reporting especially after chemical disasters. The societal driver also takes into account the declining numbers of students studying chemistry and both the public and political demands for damage control. Clark also scrutinizes what he called the environmental driver referring to new legislation forcing the testing of all chemicals and the diminishing supplies of non-sustainable resources. The notion of producer *responsibility* remains essential in his paper. Clark describes the reasons that make chemists advance the recasting of their own activities from within current laboratories and factories. Chemistry is thus understood as deeply embedded in a society and interrelated to it. Moreover, this society defines the meaning of the word "environment", the laws and the standards and norms that limit what it is acceptable to do with the environment or what is not. Clark thus depicts green chemistry as an engaged science that comes to grips not only with social and political requirements but also with the needed co-evolution between industry and academic research, between society and science, and between knowledge and moral considerations such as the respect for both life and the environment. Green chemists are trying to change the way chemistry is done so as to reduce and control damage to the environment. These changes could induce the reformulation of the operational, symbolic and normative frameworks within which chemists give sense and direction to their actions. This shift in the way some chemists are doing their work depends on factors partly *external to* the chemical procedures themselves, that is to say on aesthetic, moral or political aims in a period in which sustainable development is a leading political leitmotiv. Green chemistry is currently in process. It may succeed in reshaping and transforming chemistry or, maybe, it could fail or just be, at last partly, a green washing enterprise. We do not know. However uncertain its future may be, the notion of *praxis* is more relevant than that of practice in order to analyse

such scientific evolution. As Anastas and Williamson, two leading chemists of the field, assert:

> For those of us who have been given the capacity to understand chemistry and practice it as our livelihood, it is and should be expected that we will use this capacity wisely. With knowledge comes the burden of responsibility. Chemists do not have the luxury of ignorance and cannot turn a blind eye to the effects of the science in which we are engaged. Because we are able to develop new chemistries that are more benign, we are obligated to do so. (Anastas and Williamson, 1996, 1)

Recent revisions of the attitudes to GM crops, paying attention to benefits for people, have drawn the practice of this kind of agriculture towards seeing it as a "praxis", that is a practical activity having intrinsic moral value. It is the case, for instance, of permaculture, which originally meant "Permanent Agriculture." Permaculture is often viewed as a set of gardening techniques, that is as applied practices, but its central theme is the creation of human systems both agricultural and social which provide for human needs, but drawing inspiration from what its protagonists call "natural" ecosystems. It tackles how to grow food, build houses and how to create communities while minimizing our environmental impact at the same time. According to Molisson (1979), permaculture aims to work with, rather than against, "nature," and to integrate biological ecosystems and human communities into a whole scheme. Its three core ethical and political tenets are: Earth Care, People Care and Fair Shares. This *praxis* thus emphasises patterns of landscape, function, and species assemblies, and determines where these elements should be placed so they can provide maximum benefit to the local environment. The focus of permaculture, therefore, is not on each separate element, but rather on the relationships created among elements, considering that the whole will become greater than the sum of its parts. Permaculture design therefore seeks to minimize wastes, human labour, and energy input by building systems, and maximizes benefits between design elements to achieve both a high level of synergy and a sustainable world (Mollison and Holmgren, 1978). It is diametrically opposed to intensive agriculture, which uses large amounts of fertilizers, pesticides, and labour in order to increase the per acre yield of the crop being grown. Permaculture is a *praxis*, and not a practice only.

Justifying and Criticising Practices

Broadly speaking, practices come under scrutiny on two main dimensions. Are practices in action morally acceptable, both in themselves and/or in

their consequences? Does carrying out the requirements of a practice result in an acceptable outcome according to the standards of that practice in that social/historical context? These requirements are often entangled as we shall show in analysing some examples. The framework of critical analysis is more or less the same if the purpose of the examination of a practice is to praise it or criticise it.

Familiar philosophical problems arise in considering this issue. How much virtue or utility in an outcome outweighs morally dubious aspects of the practice? Should morally praiseworthy performances of a practice outweigh the evils of collateral damage?

The criteria include efficacy – does it work, giving the required result within the latitude of the standards of that practice? Do the flowers revive when watered in the evening? Are its collateral effects within the moral limits of the social context?

The analytic scheme we are proposing for illuminating the system of concepts in which the taken-for-granted carrying out of a practice is brought to light is achieved by digging out Wittgensteinian hinges, pairs of propositions and practices, that we argue is the first step in making sense of the meta-practices of justifying or criticising first level practices. Closely tied in with this procedure is the choice of causal concepts with which to search claims for or against the efficacy and moral standing of practices in context. The practice of rubbing dirt into one side of a cricket ball is efficacious in improving "swing" but against the "spirit of cricket", the repository of many years of gentlemanly conduct. The unspoken hinge pair is *the practice of scouring the ball* and the proposition *scouring the ball improves swing.* This hinge makes sense only if an agentive concept of "cause" is taken for granted – *somebody scoured the ball*. It did not just happen.

On our analysis the identification of affordances, that is what adopting a certain practice makes possible for an agent, allows for a broader scope for moral assessments of a practice. Analysing an affordance reveals opportunity, environment, agent and relevant theoretical presuppositions.

The next step in an analysis of a practice will be to identify the agents that are presumed in identifying affordances.

Ideas about how the world is constructed can now be proposed and, in the post Aristotelian world view, these will be some version of parts and

wholes. Reasoning in these terms requires the use of mereology, the principles of part-whole inferences to construct meaningful discourses.

However, analysis continues to become more and more refined until the objects presented as the constituents of the beings beyond a certain level of analysis are no longer observable by the senses, aided or unaided. In actual scientific practice they are taken to be fungibles, beings with no individual distinguishing marks other than the nodes of space occupying structures. A world of fungibles can be no more than a series of models of greater and greater refinement, standing in for the inaccessible structures and processor reality, in our attempts to manage the world.

Each concept will be explained and its value as an analytical tool for the understanding of practices laid out. We will show how understanding the use of each concept requires the introduction of a concept that follows from the study of that which precedes it. Thus the concept of "hinge", the Wittgensteinian conception of presupposition as hinge needs attention to affordances to make its value clear; the details of the use of affordances are needed to understand why analysis of practices needs causal agency; which in turn requires a metaphysics of the parts and wholes of entities and rules for handling mereological inferences to understand fully, particularly with respect to the layer after layer of analytical refinements that lead the inquirer beyond the bounds of sense. In thinking of elements and structures in theories we find that beyond observation all constituent entities of structures are grouped into beings that are absolutely identical one with another, that is they are fungibles. Theoretical science penetrates in thought into unobservable realms described by hypotheses of fungibles, and to models, representations of possible realities as fungibles (Chapter 6), but perfectly adapted to mathematical treatments in layers of representations that are composed only of types of fungibles.

All these steps will be explained and illustrated by analyses of everyday practices and the practices of the scientist communities of now and yesteryear. Each analytical concept will be shown at work in each chapter by its role in analysing the historical practices of bloodletting as medicine, not warfare! In a different style each will be shown in the analysis of the practice of trial by jury. Many cultures have practised bloodletting, but only a few that kind of legal due process, though these have been for historical reasons widely influential. In addition, we will include from chapter to chapter other practices that seem to present interesting variations of the central theme.

Outline of the practice of the treatment of fevers by bloodletting

We claim that when such moments or even eras of transition are closely examined, they reveal instabilities in the key elements we will be describing and analysing in the main chapters of this study. In the medical example, there are two practices to be examined. One is the skilful action of extracting blood from a person. There are various versions of controlled bloodletting. Leeches, opening veins and hot cups afforded quantities of blood and so far as retrospection of the available evidence goes none afforded cures. Causality as agency shaped the understanding of what the practice could accomplish.

However, for two thousand years or more almost all medicine and many other practices hinged on the "doctrine of the four elements". This history is very well known, but it is worth reminding ourselves of the neatness and elegance of the hinge-propositions that expressed it. Though the medical applications of the four elements hinge were popularized through the influence of Claudius Galen (129–210) the source goes back at least as far as Hippocrates. There were four elements, Fire, Air, Water and Earth, manifesting themselves in the qualities Hot, Moist, Cold and Dry. In people's bodies these elements exist as four humours, Blood, Yellow bile, Black bile and Phlegm. The doctrine remains the same while all sorts of applications are made in restoring health to a body, in particular with regard to the balance of humours. For nearly two thousand years no one in the western world doubts the story of the elements and humours – failures of practices shaped by the story are put down to all sorts of contingencies. The humours and the elements they realise must be the veritable deep structure of the universe and everything within it. Here we have a perfect hinge pair – proposition and practice. An extension into a supplementary hinge for thinking about and dealing with personality gave us "sanguine", "choleric", "melancholic" and "phlegmatic". Tie this whole structure into astrology and everything is intelligible.

Outline of the practice of determining the guilt or innocence of a defendant by consulting a jury

The practice of assigning the task of determining the guilt or innocence of someone accused of a crime to a group of fellow citizens originated in Denmark and was brought to England by the Danish invaders of the 11th century. Though modified in various ways over the millennia it has

survived in Britain and the United States. Trials in these nations are adversarial, involving debates between counsels the outcome of which is adjudicated by the jury as to matters of fact. Sentencing is the role of the judge. Most other nations have inquisitorial procedures, such as Code Napoleon in France. The antiquity of this practice in English law does not necessarily show that it is the most just way of determining the guilt of a defendant. For example, the eminent lawyer, the late Sir Louis Blom-Cooper, thought that the accused should know the reasons that led the jurors to a verdict of guilt or innocence, which would at least give such a person a chance of making a better defence (*The Times*, 21 September 2018). The practice of "trial by jury" could be improved.

In both Britain and the United States members proposed for a jury can be challenged by counsel. Once empanelled a jury is generally there for the duration of the trial.

The practice of "trial by jury" involves a large number of variations and nuances of interpretation and practice. As we analyse it chapter by chapter, we will bring some but not all of these refinements into focus as we examine the cognitive and practical requirements for the procedure to command the respect of the community.

Rethinking Experimental Science

Looking around our intellectual landscape a prominent feature is the practice of scientific experiments. In orthodox philosophy of science experiments are part of a research programme as tests of the plausibility and value of scientific theories. Or rather of the truth value of some of the logical consequences of such theories. In our account, an experimental programme is a practice, more like tennis than it is a realization of a schema of formal logic like modus tollens; "if A then B – B is false, so A is false". "Refrain from taking blood from a feverish patient". "The patient recovers". "Bloodletting is not the cause of recovery from fever". This piece of reasoning from evidence and many similar examples changed medicine radically, after what seems in retrospect to be centuries of obvious failures.

If we now consider the history of chemistry, the way the periodicity of chemical properties was established is, according to us, of interest for our investigation. William Prout's assumption of the derivability of all the elements from hydrogen entailed the primacy of the atomic weight system as the criterion for classifying chemical elements. Following Prout's line,

researchers such as Johann Döbereiner pointed out accurate and astonishing correlations between arithmetical relations and chemical analogies within sets of three chemical elements, "triads." He carried out his calculations in 1829 by using Berzelius' values of atomic weights. Leopold Gmelin then widened the correlations from triads to larger "families" of elements. The proliferation of correlations and classifications occurred after 1850 when researchers started to discover new elements and to integrate the new concept of "organic radicals" into mineral chemistry. Those strategies focused their interest on local arithmetical correlations to the detriment of global analogies between chemical properties and failed in classifying elements into a coherent scheme. In 1860, during the Congress of Karlsruhe, which was the first international congress in chemistry, the Gerhardt-Cannizzaro system of atomic weight became the official framework. Using this new standard, John Alexander Newlands proposed a law of octaves (1865) while William Olding set up a whole periodic system (1865). Those classifications neither allowed them to predict new elements nor paved the way for accurate correlations of atomic weights (Nye, 1984, 1993). Mendeleev acknowledged that this congress suggested to him the idea of an *overall periodicity* of the elements depending on the increasing numerical value of their atomic weight. He believed in "chemical individuals", i.e., in the "peculiar individualities" of the elements and in "the infinite diversity of the elemental individualities" (Mendeleev, 1889, 637-640). He was not running after a *proto hyle* to think about the unity of the universe, but after a unique periodic law connecting the "multifarious *relations* of matter" and the "many-sided relations" that elements share with each other (Mendeleev, 1889, 644-645). According to Mendeleev, a crucial distinction must be made between an observable *simple body* that displays chemical and physical properties, and a *chemical element,* which "causes" those properties. This basic element possesses at least one attribute, namely, the atomic weight which served to distinguish it from the other elements, and which was used to order the elements in a unique and coherent sequence (Scerri, 2005). But the two aspects of the chemical element are mutually dependent in Mendeleev's system. The possibility of considering something to be invariant cannot be detached from empirical observation, since the knowledge about each particular element is *continually adjusted* to experimental results.

This rupture from Lavoisier's standpoint enables Mendeleev to predict some properties and the existence of other elements such as *eka*-iodine. Mendeleev brought chemical similarities and *contrasts* to the fore and paid attention to differences between elements. In doing so, he gradually

construed a network of relations thanks to approximations and a careful study of available elements by means of trial and error. He defined an element from within its *relations* with other elements. This contrast helped Mendeleev to identify an interesting *regularity* as regards the differences in their atomic weights (Scerri, 2007; Bensaude-Vincent and Stengers, 1996 [1993]). He carried out his procedure by taking the average of the sum of the values of the four elements flanking the element in question. In doing so, he accurately calculated the atomic weight of the element selenium (Scerri, 2001). He thus gradually co-defined elements by means of their relations with other elements. Some groups of elements share similarities and it is always possible for a chemist to foresee a kind of reaction between elements belonging to two different columns. The initially dispersed facts begin, from now on, to be organized. Instead of coexisting in indifference, they are ordered around a centre of precise reference, that is the element at stake. The unification thus construed plays an immediately functional and productive role; it sets up a total table applicable to future observations and assigns to them a given direction.

The way elements were discussed in the Congress of Karlsruhe, the epistemic cultures of his time, his rejection of Prout's hypothesis which was nevertheless considered to be an indispensable cornerstone of chemical studies at this period, and his use of two interdependent aspects of the notion of elements, one being abstract and the other related to concrete substances, partly explain why Mendeleev succeeded in achieving a classification whereas others failed to do so. Those later had to pay the price of having: (1) accepted faulty premises defended by conservatives belonging to different rival research approaches, including agreement with the monism defended by Prout, and (2) followed the local arithmetical search for correlations which, albeit valid, led them to falsity.

Chapter Two

Wittgenstein's Hinges Elaborated

Our methodology draws on a development of Wittgenstein's "hinge" concept, as interpreted and developed in recent studies of his later writings, in particular *On Certainty* (Wittgenstein, 1979). In trying to understand a scientific or legal or theological discourse and those of many other genres, from a philosophical point of view, that is with respect to the concepts in use, we look for propositions which have gone unformulated and so unchallenged and once formulated seem germane to the assessment of the intelligibility of habitual procedures and practices in a certain field. We try out certain kinds of presuppositions that might shape our importation of content into the bare bones of a formal presentation of an explanation, a practical manual or a relevant cluster of discipline defining propositions.

The modality we are hoping to establish clearly, via Wittgenstein's "hinge philosophy", occupies the territory of the well-known philosophical concept of synthetic a priori, at a local level, in respect of technically advanced domains of enquiry. Such propositions were declared to be "synthetic", that is brought together, a concept with another that was not part of its meaning, but were a priori, that is not arrived at from experience.

Danièle Moyal-Sharrock (2004) and others have interpreted hinges not as "somethings", for example hypotheses, that *underlie* or *support* or *imply* practices or procedures. Hinges are implicit in our activities, but they do not have an independent existence. We know them only as expressed in a proposition-procedure pair, "doppelgangers" of one another as Moyal-Sharrock has it. Once made explicit, propositions like "Life on earth has existed for millions of years" can be examined and sometimes tested as putative matters of fact. If they seem plausible, they can be used to defend the point of procedures and practices such as going to Lyme Regis and cracking rocks in the hunt for fossils.

In general, a propositional expression of a hinge seems to express something entirely obvious but nevertheless a matter of fact which might have been otherwise. Its doppelganger is taken to be a fertile and trustworthy procedure that makes sense in the light of the truth or plausibility of its propositional partner. In playing golf on earth the propositions and procedures requiring attention to the gravitational field are a hinge cluster, the presence or strength of which is never discussed on the golf course – but this is not the situation for golf on the moon. Alan Shepherd had to attend to the attributes of the lunar gravitational field, attributes of the earth's gravity that had been taken for granted in the corresponding proposition-practice doppelganger pair on earth. The planning and interpretation of experiments on the space station are framed by different hinge-proposition-hinge procedure pairs from those on earth.

Hinges exist only as expressed in taken-for-granted pairs; hinge-propositions and their doppelgangers, hinge procedures or practices. The relevant propositions are unformulated and so not examined empirically, and the paired procedures are habitual and more or less skilful, usually not guided by an experienced and skilled actor paying attention to explicit rules.

Authors of established genres of scientific discourses and other professional literary genres work with practical modalities, natural necessity and empirical possibility. These modalities are established within a framework of tacit knowledge and skill, we can set out as Wittgensteinian hinges – expressed as doppelganger pairs, propositions and practices. A propositional hinge serves as the *a priori* condition for the intelligibility of the discourse in question ("There is a layer of more ancient writing under the visible text"). A practical hinge, its doppelganger, is expressed in the mastery of the skill which should be used to achieve a certain result ("Here is a photographic technique to make the ancient writing legible").[1] For chemists, matter has always been considered to be active, multifarious, and heterogeneous. Depending on how chemists act upon matter, they can obtain such or such a product having a certain degree of purity or such and such a mixture having interesting reactivity and dissolving power. The practice of nanoprecipitation currently refers to propositions like "Crystals of ZnO are context-dependent". As a matter of fact, the structure of a crystal depends on what surrounds it, and on the device being used in order to synthesize it. But chemists cannot carry out any nanoprecipitation without taking for granted that matter is heterogeneous and/or multifarious:

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[1] We take this example from a report in *The Times*, 28 August 2017, "Ancient remedies lie hidden behind monastery scriptures".