The Representation of Reality in the Intelligent Use of Tools

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Abstract

Starting from some results of neuroscience, and especially of Embodied Cognition, I'll discuss the problem of the intelligent use of tools, as a useful perspective under which to investigate the link between common knowledge and scientific knowledge. The philosophical question from which I shall start my reflection is the following: how do we represent reality to ourselves when we intervene on it through the intelligent use of a tool? The answer to this problem will be developed in two fundamental steps. 1. The problem of the intelligent use of tools will be approached from the neuroscientific point of view of Embodied Cognition, from which, however, one risks drawing the impression of a radical separation between a common, practical knowledge and a more idealized scientific knowledge. 2. No such absolute separation exists, however, because all our representations of reality, when we intervene on it in a technical-practical sense, through the intelligent use of tools, depend on a collaboration between cognitive and motor elements of knowledge. This collaboration will be further exemplified through the Polanyian distinction between subsidiary and focal elements of knowledge, through which a functional mechanism can be identified, whereby knowledge is always mediated by action, both in our everyday activities and, at a more elaborated level, in science. Thus, a difference emerges, not in principle, but only in degree between common knowledge and scientific knowledge.

Keywords: Intelligent use of tools, Embodied cognition, Cognitive and motor elements of knowledge, Common knowledge and scientific knowledge.

> *With advancing age Renoir became crippled with arthritis. He lost the use both of his feet and hands; his fingers were immobilized in perpetual cramped rigidity. Yet Renoir went on painting for another twenty years until his death, with a brush fixed to his forearm. In this manner he produced a great number of pictures hardly distinguishable in quality or style from those he had painted before. The skill and the vision which he had developed and mastered by the use of his fingers, was no longer in his fingers.*
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> (Polanyi 1958: 355, my italics)

1. Introduction

The quote I have chosen, taken from one of Michael Polanyi's major works, *Personal Knowledge*, seems to me to be particularly significant in introducing the

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themes my paper will focus on. The philosophical question from which my reflection starts is the following: how do we represent reality to ourselves when we intervene on it through the intelligent use of a tool?

The answer, in short, is to show how this representation occurs through a close collaboration between cognitive and sensorimotor elements of knowledge. Such collaboration emerges when we use a tool intelligently, both in our everyday 'practical' knowledge (common knowledge) and, at a more elaborate level, in scientific knowledge, which aims to produce controllable and sharable knowledge. When we speak of the intelligent use of tools, we mean all those situations, starting from our everyday actions up to the application of the most elaborate scientific and technological practices, in which we make use of tools that mediate the relationship between our body-mind system and the surrounding environment. If we consider, therefore, the relationship between cognitive and sensorimotor aspects of knowing in the intelligent use of tools, we come to deny, on the level of an epistemological critique, the difference in principle between a common, more technical, body-related knowledge and a more abstract, scientific knowledge. When we intervene on the reality, in a technical-practical sense, using particular tools, it is never possible to clearly separate theory from praxis (cf. in particular Buzzoni 1995, 2004, 2005 and 2008). In particular, this paper takes up and develops, extending them to the relationship between common knowledge and scientific knowledge, some considerations already presented in Buzzoni and Savojardo 2019.

Two fundamental steps, developed in the first and second paragraphs respectively, will be necessary in order to demonstrate the main thesis of this paper, according to which the nexus between motor and cognitive aspects in our representation of reality, when we intervene on it in a technical-practical sense, is an aspect that unites so-called common knowledge with scientific knowledge. Any radical in-principle separation between different types of knowledge, therefore, falls apart when we consider how we represent reality to ourselves when we intervene on it through the intelligent use of tools.

The first paragraph is intended to frame the problem of the relationship between motor and cognitive aspects of knowing from the perspective of Embodied Cognition, according to which cognitive activity depends not only on brain activity but also, and above all, on the action of the body on the mind (cf. in particular Rupert 2009, Shapiro 2010 and 2019). The nature of abilities in the intelligent use of tools is one of the most debated topics in this area: the solutions proposed at a scientific level are as diverse as the problematic nodes within the debate. As we shall see, the tendency of Embodied Cognition is to reduce the abilities related to the use of tools to the sensory-motor level (cf. Chao and Martin 2000, Grafton et al. 1997, Sakreida et al. 2016, Ferretti 2021, Iriki et al. 1996, Maravita and Iriki 2004), thus avoiding the opposition between motor and cognitive aspects, an opposition that nevertheless emerges in the face of some important challenges that Embodied Cognition cannot ignore. If, on the one hand, the use of familiar tools requires the retrieval of manipulative knowledge of a sense-motor nature, stored in our motor system, on the other hand, both the selection, creation and use of new tools, and the use of familiar tools employed in a new way, seems rather to require certain specific conceptual skills (Caruana and Cuccio 2015). The use of certain purely cognitive functions of a causal or inferential nature—referred to as 'technical reasoning' (Osiurak et al. 2010) or 'mechanical problem solving' (Goldenberg and Hagman 1998)—seems necessary.

From this debate, an important distinction emerges between a knowledge that we could define as sensorimotor, mostly linked to the use of familiar tools, in certain particular situations in which the tool ends up implying a change in the sensory system in which it is incorporated, and a more abstract knowledge that concerns the objective relations that apply between the objects themselves, regardless of our particular sense organs and the context of interests and meanings in which the objects are used (cf. in particular Osiurak 2014 and Goldenberg 2013). In the face of such neuroscientific findings, what can philosophical reflection say?[1] Developing in the light of the empirical data provided by scientists, on a philosophical-epistemological level, the risk emerges that the tension between hypotheses about cognitive and sensorimotor abilities in the intelligent use of tools, could turn into a form of dualism between distinct types of knowledge. On the one hand, there would be a common knowledge, which we can find in the use of familiar tools, a 'practical' knowledge that accompanies us, mostly unconsciously and automatically, in our daily activities, and on the other hand, a more abstract scientific knowledge, which concerns the objective relations between physical objects and which seems to be mostly about the invention of new tools or the use of familiar tools in an original way.

The second part of this paper will show that this distinction in principle cannot apply in our technical-practical intervention in reality, in which it is not possible to separate thought from action, because in it the use of any tool always becomes an intelligent, conceptually mediated use. Technical and practical elements linked to the use of our body intertwine with cognitive elements, as we try to focus on an aspect of reality, intervening on it through a tool. This applies in the context of common knowledge, as in science. The principled distinction between the two fields, therefore, no longer makes sense. In order to support this argument, I will finally refer to the Polanyian distinction between subsidiary and focal elements of knowledge. This distinction is in fact taken up by Polanyi himself in order to clarify the use of tools that we commonly assimilate to our body in order to carry out certain technical-practical operations, both in our everyday life and, at a more elaborate level, in scientific practice. Without going into M. Polanyi's thought in depth, reference to his epistemology of the human person will be useful to clarify the link, of unity, on the one hand, and distinction, on the other, between the motor and cognitive aspects of knowledge. On the one hand, indeed, with respect to our technical intervention in reality, it is necessary to deny the clear separation, in an ontological sense, between two spheres of knowing, one practical, linked to the body, and one more abstract, linked to the action of the mind; on the other hand, however, this necessity does not prevent us from distinguishing, in a sense that can be said to be functional, two perspectives on reality.

Bearing in mind the Polanyian proposal, we speak of a functional distinction with reference to the knowing subject who, in the performance of any practical activity, as in the use of particular tools, in our everyday life, or in science, can choose whether to direct his or her focal, immediate attention to the so-called

[1] By examining the representation of reality in the intelligent use of tools, this paper is part of the collaboration between philosophy and cognitive sciences (cf. expecially Bennett et al. 2007 and Bennett and Hacker 2022). If indeed, on the one hand, cognitive sciences open up the study of certain mental processes to empirical investigation, on the other hand, philosophy has the task of questioning the tools for investigating these processes, highlighting their limits and potential.

subsidiary elements, mostly linked to the use and involvement of the body; or the subject can act from these elements, incorporating them or integrating them in an almost automatic way into his or her complex body-mind system.

The problem of the intelligent use of tools, investigated in the context of Embodied Cognition, may thus be considered a paradigmatic case useful in showing the link between motor and cognitive aspects of knowledge, and thus the link, in a more general sense, between common knowledge and scientific knowledge.[2]

2. Embodied Cognition and the Intelligent Use of the Tool[3]

Our ability to use everyday tools requires different skills and is today a topic of great interest not only for cognitive psychology but also for philosophy and neuroscience. In particular, the problem of the nature and the role of the abilities involved in the intelligent use of tools represent a challenge for Embodied Cognition,[4] which aims at investigating the mutual dependence between body and mind, re-evaluating, compared to traditional cognitive theories, the role of the body in the different cognitive functions. Embodied Cognition is distinct from (but also closely intertwined with) three other research paradigms: those according to which the mind must be considered not only as 'embodied', but also as 'embedded', in both a natural and cultural context (Hutchins 1995), 'extended', i.e. extended to its instrumental extensions (Clark and Chalmers 1998, Wilson 2004, Menary 2010), and 'enactive', i.e. capable, through its action, of perceiving and structuring the world in which it finds itself (Varela, Thompson and Rosch 1991, Noë 2004 and Thompson 2007). From these perspectives, the cognitive system is not about a disenchanted Cartesian mind that manipulates symbols, it is based on human interaction with the physical, cultural and social dimensions of the world.

In Embodied Cognition, the answers to the problem of intelligent tool use have been concentrated around two opposite poles. The prevailing tendency has been to attribute skills related to the use of tools to the sensorimotor level, putting more cognitive skills in the background. On the contrary, a second trend, especially to explain the new and original use of tools, has considered it necessary to introduce types of reasoning that would be based on the acquisition of abstract mechanical laws, at least partially independent from the functioning of the motor system. The use of tools seems to represent a capacity situated halfway between sensorimotor skills and more abstract cognitive skills.

The first trend can be seen, for example, in two of the main answers that neuroscientists, in Embodied Cognition, have provided to the problem of the

[2] It may perhaps be useful to note that this article neither intends to distinguish between sensorimotor knowledge on the one hand and a more abstract knowledge of the physical characteristics of objects on the other (see for this distinction Osiurak 2014 and Goldenberg 2013), nor to identify these two types of knowledge with, respectively, common knowledge and scientific knowledge. What is at stake here is only to highlight how some problems that have emerged from the debate within neuroscience may cause philosophical reflection to run the risk of a dualism between two types of knowledge—one common, more practical, and one scientific, more abstract—dualism that is not defensible if we think about the way we represent reality by intervening in it through the intelligent use of tools.

[3] On this point, see also Buzzoni and Savojardo 2019.

[4] For a general overview of the topic, see the following texts: Shapiro 2019 and Palmiero and Borsellino 2018.

intelligent use of tools: that of *affordances* and that based on the concept of *embodiment* of the tool in the subject's motor schema.

According to the theory of affordances (see e.g. Chao and Martin 2000, Grafton et al. 1997, Sakreida et al. 2016, Ferretti 2021), initially inspired by Gibson (1979), the observation of the characteristics of a tool is able to evoke the motor programme necessary for its use. The characteristics of an object suggest to the agent the appropriate way to use the observed object: the affordances theory is therefore based on the necessary agent/object relationship. As has been observed, however, this relationship implies a reference to further, equally necessary relationships between the instrument and the structural characteristics of the objects and materials with which the instrument relates. Already with reference to the theory of affordances, certain problematic aspects have been stressed in the literature. If it is true, in fact, that the affordances of an object determine the agent/object relationship by enacting a series of transformations at the visual-motor level, the other relationships involved in the intelligent use of tools, such as the relationship between the object and other objects, or the different ways in which a tool can be used, cannot be explained through the affordances theory alone, as such operations seem to require further work at the semantic-cognitive level (cf. Caruana and Cuccio 2015).

A second sensorimotor theory supported in the field of Embodied Cognition is the one founded on the embodiment of the instrument in the subject's motor schema (see e.g. Iriki et al. 1996). This theory is based on the idea that the use of an instrument implies a change in the sensory and motor system in which the instrument itself is embedded. The tool thus becomes part of a new physical entity; hence the idea that the use of tools requires, rather than a complex series of cognitive elaborations, a plastic body schema, capable of incorporating external elements into itself (for a review, see first of all Maravita and Iriki 2004, but see also the following works: Berlucchi and Aglioti 2010, Johnson-Frey 2003, Cardinali et al. 2009, Caruana 2012).

However, the insistence on the sensorimotor aspect with which these theories have often been supported has provoked, in reaction, an opposite trend. Studies that have provided results in favour of the existence of an affordance effect, for instance, have shown that the latter is nevertheless conditioned by perceptual selection processes (cf. Makris, Hadar and Kielan 2013). Multiple experiments, moreover, have shown that what an individual intends to do with an object, i.e., the goal he or she has in mind, changes the hand attitudes during the movement to grasp the object (see e.g., Sartori, Straulino and Castiello 2011, Caruana and Cuccio 2015). Above all, while sensorimotor skills prevail in the case of standard use of familiar tools, in the cases of using new tools on the basis of analogy with known procedures and in the case of using known tools according to new procedures, mental operations seem to be involved which, although connected to the motor system, cannot be traced back to it without residue. Familiar tool use naturally always requires, at least to some extent, a set of sensorimotor skills, but the finding that certain brain damage is more significantly correlated with difficulties in both using new tools and using old tools in a new way, rather than with using familiar tools, has been deemed sufficient to postulate the existence of particular cognitive skills (Goldenberg and Spatt 2009: 1653).

There is a common tendency to consider the ability to use certain objects in an original way as if they were particular tools (a coin as a screwdriver) or the ability to use certain tools in an unconventional way (a fork as a comb) as evidence of intelligence. These are in fact actions that require a certain amount of reasoning about the structural and mechanical characteristics of the object:

> A basic requisite for detecting non-prototypical uses of common tools or possible uses of novel tools is recognition of structural properties which determine the possibilities and limits of mechanical interaction with other objects. For using a coin to replace a screwdriver, flatness and rigidity are decisive structural properties. Flatness permits insertion of the coin into the slot of the screw, and rigidity secures transmission of rotation from the hand via the coin to the screw (Goldenberg and Spatt 2009: 1646).

In particular, knowledge of the structural properties of a tool is primarily concerned with the interactions of the tool with other objects or materials, rather than with the relationship between the object and the acting subject. For these reasons, the concepts of 'mechanical problem solving' (Goldenberg and Hagman, 1998), 'mechanical reasoning' (Hegarty 2004) and 'technical reasoning' (Osiurak et al. 2009, Osiurak et al. 2010, Osiurak 2014) have been introduced. They would all be based on the acquisition of abstract mechanical laws, at least partially independent of the functioning of the motor system, and would easily explain the paradigmatic case of the unconventional and new use of already known tools.

Now, a careful examination of some of the pages or assertions of the participants in this debate shows that, although we are here predominantly faced with a tension between empirical hypotheses that tend to be opposed with respect to the solution of a particular scientific problem, there is in some cases, at a properly philosophical-epistemological level, the unconscious introduction of a certain naturalistic reductionism or philosophical dualism, respectively. The distinction between sensorimotor knowledge and a more abstract knowledge of the general principles of physics and mechanics can be illustrated by two examples taken from two different authors.

According to Osiurak "sensorimotor knowledge is supposed to contain information about the usual manipulation of tools (egocentric, user-tool relationship), and not about the objects with which they are usually used (allocentric, toll-object relationship)" (Osiurak 2014: 91). In other words, on the one hand, there is knowledge that is directly dependent on and related to our interests and the concrete and particular situations in which we find ourselves, and on the other hand there is knowledge that concerns objects as such, and thus abstract and universal knowledge, or knowledge that is valid in itself; on the one hand, knowledge that has to do with the particular as the direct object of our cognitive and practical interest, and on the other hand, knowledge that examines the objective relations between the objects themselves, regardless of our particular organs of sense and the context of interests and meanings in which we use them.

This opposition (which can easily be related to the old dichotomy between things for us and things in themselves) can also be found, albeit more indirectly, in Goldenberg. He introduces a so-called intermediate knowledge that accompanies us throughout our lives and is acquired in and through our moving in a three-dimensional world occupied by solid objects (cf. Goldenberg 2013).

Now, the introduction of an intermediate term in no way attenuates the epistemological opposition presupposed here between a sensorimotor knowledge in particular or individual situations, which properly concerns the use of familiar tools, and a knowledge that, to use a passage quoted by Goldenberg and Spatt

2009, contains "the comprehension of mechanical interactions of the tool with other tools, recipients or material" (Goldenberg and Spatt 2009: 1653), that is, an abstract and idealised knowledge.

Despite the fact that these authors speak of a cooperation between the two types of knowledge, the distinction between the two fields is repeatedly stressed and risks appearing as a qualitative and principled difference between different forms of knowledge.

If the dualism between a sensorimotor knowledge that seems to be bound to the body, and a more abstract knowledge aimed at mechanical laws that concern objects considered in themselves, loses all contextual relativity, we end up presupposing, at a philosophical-epistemological level, a distinction between two cognitive domains that is in no way tenable for the epistemological reasons we will examine shortly.

Neuroscientific findings around the problem of the intelligent use of tools, in the specific field of Embodied Cognition, constitute the starting point for philosophical reflection. As we shall see, in fact, at the philosophical-epistemological level, a clear separation between the following two types of knowledge is not tenable: a practical or technical knowledge that accompanies us in an almost automatic or unconscious manner in our daily activities, and a scientific knowledge, which specifically concerns the objective characteristics of the objects we use and aims at complete intersubjective controllability.

3. The Representation of Reality and our Practical-Technical Intervention in It

Starting from the debate on the intelligent use of tools in Embodied Cognition, in the light of some important experimental results (cf. especially. Brandi et al. 2014, Valyeaar et al. 2007, Osiurak et al. 2010, Goldenberg and Spatt 2009), it is evident how difficult it is for neuroscientists to succeed in defining the relationship between cognitive functions and the sensorimotor functions that determine the intelligent use of tools by human beings. As I have said, the risk, at the philosophical-epistemological level, is that of arriving at a principled difference between a technical or practical knowledge linked to the body and a more abstract and objective scientific knowledge.

The purpose of this paragraph is to show that this difference is not tenable if we consider our technical-practical intervention in reality an intervention that often makes use of particular tools, both in our everyday activities and in science. As we shall see, however, this statement does not prevent us from understanding the distinction between these spheres in a new sense, not as a clear separation of principle, but as a difference of perspectives on the same reality.

When we make use of any instrument, from the stick to move in the dark to the probe to explore space, we do so with the aim of intervening in the reality around us, guided by an underlying intention that may be that of seeking the exit from the dark room we find ourselves in or that of getting to know new aspects of the spatial universe. In this sense, the use of an instrument that mediates between our body and reality is always an intelligent use and this presupposes an important link between thought and action, and between cognitive and motor elements of knowledge, in our technical-operational intervention on reality.

To make this point clearer, let us start with experimental science. The general idea is that the theoretical moment and the technical moment are two aspects that can be distinguished in experimental science only on the level of reflection, because, on the one hand, in the concreteness of doing science, the theoretical moment is the condition of possibility of the knowledge of certain aspects of reality and of possible causal links that can be resolved, in principle, in technical applications accessible to the entire scientific community; on the other hand, the technical moment possesses truthful relevance when it translates into conceptually mediated actions (cf. Buzzoni 2008: 24-25). There is no human knowledge that is absolutely non-technical, just as there can be no knowledge that is merely practical-technical, unmediated by concept. This means that any attempt to epistemologically separate pure, abstract or idealised science from its practical applications is doomed to failure. Knowledge of empirical reality cannot be separated from a practical or instrumental intervention in nature, an intervention that, in turn, is always mediated by the concept, without which action could not be distinguished from mere chance occurrence.

In support of this argument, we consider the role of counterfactual assumptions, which outline a series of conditionals present in science (see especially Williamson 2016 and 2020), as in common thought. In everyday life, in fact, the mind often constructs possible alternative scenarios to real situations, scenarios that allow the agent to move in the real world, for example, as some empirical research has also shown, through a type of reasoning by opposites. According to some recent studies in cognitive psychology (see in particular Branchini et al. 2016, 2021, Bianchi and Savardi 2006, Bianchi et al. 2017a, b, 2020, Byrne 2016, 2018, Dumas et al. 2013, Evans 2007), the role of opposites should in fact be understood as a general organising principle of the human mind. Interestingly, it is also able to represent a certain perceptual datum by hypothetically excluding other possibilities, which are not directly perceived by the senses: it is possible, for example, to perceive the red of a rose, the object of direct observation, hypothetically assuming the possibility that it could be another colour, and then rejecting this possibility on the basis of the relationship between my eyes and the object. Now, without this hypothetical capacity of the mind, our techniques of intervention in the reality would be indistinguishable from the simple natural change of things. Our reasoning in a counterfactual manner becomes the condition of our interventions on the real, showing different cause-effect links in empirical reality from time to time. Certainly the same mental processes that we use in our daily lives also apply to scientific thinking, albeit at a more elaborate cognitive level: without the construction of counterfactual scenarios, the scientist could not intervene in reality in any way. Like the historian, the natural scientist too, in order to explain a certain event, must ask oneself what might have happened in hypothetically different situations (for such considerations see especially Buzzoni 2008: 116-117).

When we use any tool, cognitive and motor elements work together, in the development of a knowledge that is also always acting. But if on the one hand we cannot accept the difference in principle between two separate cognitive spheres because, as we represent reality in our technical intervention in it, our thinking necessarily translates into shared practices; on the other hand, the distinction between cognitive and motor elements of knowing in the use of tools can be reconsidered by examining the distinction between subsidiary and focal elements of knowing by the Hungarian philosopher M. Polanyi. The relationship between these elements is, in fact, used by Polanyi both to exemplify the mechanisms underlying the intelligent use of tools and to clarify the body-mind relationship.

In order to understand the meaning of the distinction between subsidiary and focal elements of knowing, and how this distinction can be useful in clarifying the link between cognitive and motor aspects of knowing always mediated by action, it is necessary to introduce the Polanyian concept of 'tacit knowledge'.

Even scientific knowledge, which seems at first sight to present itself as completely explicit knowledge, according to Polanyi, contains a 'tacit' or 'unexpressed' moment, connected to pre- or a-linguistic skills. The role assumed by such skills in the scientific enterprise is, however, a serious problem (cf. Buzzoni and Savojardo 2019 and Savojardo 2013). If we understand these abilities as something in principle inexpressible in the form of verbal and discursive knowledge, they end up being part of an obscure background inaccessible to rational reconstruction. One would arrive, in this sense, at an ontological distinction between two realities, one expressible and the other unexpressed, tacit, or in any case not completely translatable on a conceptual level. In this sense, one cannot accept, from an epistemological point of view, the presence of a logical or explanatory vacuum in scientific knowledge, which by definition must be an intersubjectively controllable and reconstructible knowledge in every step. If, on the other hand, the distinction between tacit and explicit is understood in a functional sense, as if the transition from one sphere to the other coincided with a change of perspective on the actual data, then it is possible to think of science as always being connected to implicit knowledge that can in any case, in principle, become explicit.[5] Thus not only can an implicit ability be made explicit, but also an explicit ability can become implicit and operate at an unconscious level, in a circular but always renewed relationship between tacit and explicit.

In order to clarify how the relationship between tacit and articulate knowledge can be understood in a functional sense, we can turn to the studies of Gestalt psychology on perception, following the Polayian proposal and the distinction between subsidiary and focal awareness of the details of an object.

Polanyi identifies a 'logic of tacit inference' in the example of perception and the figure-background relationship through which we are able to focus on an object in front of us: "Every time we concentrate our attention on the particulars of a comprehensive entity, our sense of its coherent existence is temporarily weakened; and every time we move in the opposite direction towards a fuller awareness of the whole, the particulars tend to become submerged in the whole" (Polanyi 1969: 125).

Now, what is true for the attention paid to details, which risks making us lose the meaning of the whole, is also true for the abilities connected to the use of our body, which tend to become paralysed if the gaze of the person performing them is directed at single bodily movements: a pianist who shifts his attention to his fingers while playing risks becoming confused and will be forced to interrupt his performance. However, it is thanks to the details, seen as a whole, that we are

[5] There is an important oscillation in Polanyian thought with respect to the role of tacit ability. On the one hand, in fact, perhaps also due to the polemical intent towards logical empiricism, Polanyi sometimes seems to affirm that 'abilities' are in principle inexpressible in the form of verbal-discursive knowledge. On the other hand, Polanyi does not understand the distinction between tacit and conscious abilities as an ontological distinction, but rather as a distinction of a properly functional kind. In this case, the distinction between tacit and conscious abilities is no longer linked to the ontological distinction between, on the one hand, a reality that is in itself inexpressible and, on the other hand, a reality that is in principle expressible (cf. Buzzoni and Savojardo 2019 and Savojardo 2013).

able to identify an object or perform an activity. By this route Polanyi arrives at the fundamental conclusion that there are two views, two ways of being aware of the same reality: a 'subsidiary' or 'tacit' awareness of the details, which allows us, at a deep level, to grasp the object in its entirety, and a 'focal' or direct awareness of the details, in which the comprehensive unity tends to dissolve into a myriad of details (cf. Polanyi 1969: 113-14).

These two types of views, intentionality or awareness, express the non-ontological but functional way (what is focal can become subsidiary, or vice versa), in which Polanyi draws the distinction between explicit and tacit knowledge, a way that is decisive for the issue of understanding the intelligent use of the tool (cf. Buzzoni and Savojardo 2019). Polanyi himself illustrates the distinction between focal and subsidiary awareness with the example of using a hammer: while we use a hammer to drive a nail into the wall, we pay attention to both objects, but in an entirely different way. We try, in fact, to use the hammer in a certain way, mindful of the blows on the nail: we are primarily interested in achieving our goal, but "we are certainly alert to the feelings in our palm and the fingers that hold the hammer. They guide us in handling it effectively" (Polanyi 1958: 57). It is evident that the use of the instrument cannot be separated from that of our own body, to which the same distinction between subsidiary and focal awareness can be applied. The fact that all our conscious interventions in reality involve the subsidiary use of our bodies means that this can be defined as "the only aggregate of things of which we are aware almost exclusively in such a subsidiary manner" (Polanyi 1969: 214).

When we learn to use a new tool or when we use an already known tool in a new way, it is as if we extend our bodily equipment to include the tools we have encountered. The tool becomes part of our bodily system and the mind relates to it as an element of its own body, and thus as a part of itself as an entity acting in the world.

The knowledge of our body, like that of the tools we assimilate to it, when we intervene in a technical manner on the reality, in most cases, is a knowledge that remains at a tacit level. Tacit knowledge is, in fact, repeatedly defined by Polanyi as unlimited knowledge through which we tacitly understand something about ourselves as persons engaged in the search for truth. It is an implicit knowledge that concerns the indirect or 'subsidiary' awareness of ourselves, of the skills and tools that we assimilate into our personal being: "*We always know tacitly that we are holding of our explicit knowledge to be true*" (Polanyi 1959: 12). That 'we' includes our being living bodies in a space of action that is only part of the cultural reality in which we have always been embedded. Everything that relates the person to the context that surrounds him or her has an instrumental value starting from the body, from the tools we use in our daily lives, up to the most complex information technologies. From this point of view, words and concepts also have a similar instrumental value connected to the person who uses them to make explicit knowledge that was initially only implicit and to communicate. In an interesting passage, for example, Polanyi (1969: 145) constructs a parallelism between the acquisition of a language and the use of a common tool, such as a stick: the transformation of meaningless sounds into words depends on the process of language acquisition, through which direct attention to sounds becomes attention from them, towards the object of reference. This vector property of language, linked to the principle of transparency, concerns those who master a language. The same can be said of the use of a stick to learn to move in the dark: when we first use it we will pay attention to every blow against the palm and fingers of our hand, every time the stick encounters an object; but when we have learnt to use it in the correct manner we will no longer pay attention to the insignificant blows on our hand, but will pay attention from them to the end of the stick that intercepts the obstacles in the room. Words and instruments are such for me and thus become part of my personal (and not subjective) instrumental apparatus.

Through the Polanyian proposal of an epistemology of the human person, one can reconsider the distinction between motor and cognitive elements of knowing as a functional distinction, a difference in perspective, dependent on personal choice. The subsidiary awareness of my body, understood not so much as an object among others, but first and foremost as a lived body in action, accompanies all my verbal, conceptual or explicit knowledge. But if I wanted, I could at any time shift my focal attention to the subsidiary elements that make up my body, thus making the individual bodily organs the object of study and interest. And this, after all, is also what the surgeon does while operating: he does not see the organs as subsidiary elements of a living body, of a person embedded in his or her environment, but regards them directly as individual objects worthy of attention in themselves. The change of perspective on the real, however, cannot be understood except by referring to that place of personal encounter between subsidiary and focal elements of knowledge, that centre of commitments and interests that is the human person. From this point of view, the intelligent use of any tool, from the stick for moving in the dark, to the terms of one's own language, to the technical instruments of a specific scientific discipline, becomes the use of a piece of nature in a personal project, connected to the space of action of a body understood first and foremost as that set "of things known almost exclusively by relying on our awareness of them for attending to something else" (Polanyi 1969: 147).

Always, when we intervene in a technical-practical sense on empirical reality, we do so by using different tools (conceptual and otherwise) that affect us and are part of us as persons. Consider, for example, the quote at the beginning of this paper, from which it emerges that the ability to paint and see things in a certain way, for Renoir (paralysed by arthritis), no longer resided in the individual cobody organs, it had 'shifted' to the instrument which became part of the person as a body-mind unit. This description clearly exemplifies how an instrument becomes an integral part of the person as an inseparable body-mind unit, whose body is capable of intervening in reality because it is guided by a type of reasoning that is never, from an empirical point of view, 'pure' or separated from the sensorimotor sphere. This statement, however, does not imply any reductionism of the mental to the physical, let alone a form of philosophical dualism. The way we represent reality in our technical-practical intervention in it is determined by the type of perspective we decide to put into practice in our 'attempts' at problem solving, ranging from solving simple problems in everyday life to studying complex and intricate situations in the natural and social sciences. Consciously, we can, in fact, decide to direct our focal attention to all the clues or details that are part of us because they are part of our 'subsidiary' equipment by means of which we deal with different problem situations (but in this way we will lose an overall view); or we can choose to look from these subsidiary aspects and beyond them to grasp the solution to the problem, in a unitary sense.

As already pointed out, in the personal being understood as an inseparable unity of mind-body, the mind can be aware of body parts, as well as of all those instruments (conceptual and otherwise) that are integrated into our person in a direct (focal) or indirect (subsidiary) manner, and these two types of awareness also generate two ways of understanding the body-mind relationship: if we consider the individual organs in themselves, these become objects among others and the activity of consciousness is lost sight of; if, on the other hand, we consider the bodily mechanisms as subsidiary elements on which the mind relies in its conscious activities, the individual organs take on a new meaning in the inseparable mind-body unity always included in a certain space of action.

This type of functional 'mechanism', in the intelligent use of any tool, concerns both common knowledge and scientific knowledge, since every cognitive pathway develops in the interweaving of tacit and explicit, of subsidiary and focal elements, of corporeal and conceptual elements. For this reason, we have argued there is no practical, tacit or sense-motor knowledge, exclusively connected to the body, separate from another explicit or conceptual cognitive sphere: the distinction between so-called common knowledge and scientific knowledge cannot be a distinction of principle that presupposes, on an ontological level, two separate cognitive contexts. However, if we think about interchangeability relation between subsidiary and focal elements of knowledge described by Polanyi, we can reconsider the distinction between corporeal and cognitive elements of knowledge, with reference to the two different perspectives that the human person, embedded in a certain cultural, linguistic, social context, can choose to assume. In what does science consist if not in the attempt to translate the tacit into the explicit, through experiment? Although this 'translation' work takes place all the time also in common knowledge, it is stronger and more evident in science, where it is often very arduous and may take several years, than in common knowledge, for which we almost never feel the need to focus on the subsidiary elements that enable us to perform certain activities, such as walking, swimming or cycling, despite the fact that this possibility is always contemplated. From this point of view, the only difference between common knowledge and scientific knowledge can only be a difference of degree, and not of principle, since science, while developing at a more elaborate level, already contains and is always nourished by common knowledge, through a series of tacit skills that bind us to one another, in a universe that takes on the character of the person.

4. Conclusion

How do we represent reality when we act on it in a technical-practical sense, through the intelligent use of particular tools?

The paper attempted to answer this initial question by analysing the relationship between sensorimotor and cognitive aspects in the intelligent use of tools, a relationship that shows a continuity between common knowledge and scientific knowledge. The problem of the intelligent use of tools can thus be considered as a paradigmatic case useful in highlighting the link between these cognitive domains, the difference between which cannot be a difference in principle, but only in degree. The conclusion we have reached is supported by a series of arguments developed in the first and second sections respectively.

The first part of the paper framed the problem of the intelligent use of tools from the perspective of Embodied Cognition, in order to highlight some important philosophical issues that emerge in the light of the experimental neuroscientific results. With reference to Embodied Cognition, in fact, two different trends have arisen: on the one hand, the tendency to claim that tool use depends exclusively on the action of the sensorimotor system; on the other hand, the tendency to describe a type of technical reasoning or mechanical problem solving, separate from the sensorimotor system. With this problematic situation in mind, an attempt has been made to highlight certain philosophical assumptions implicit in the neuroscientific debate. The separation between cognitive and motor aspects in the intelligent use of tools, if absolutized, risks becoming a difference between common, practical knowledge and scientific, abstract knowledge.

In the second part of this paper, an attempt was made to demonstrate that this difference in principle is not sustainable in our representation of reality, mediated by our technical, practical, instrumental intervention in it. Our technical intervention in reality is always mediated by concept, and our reasoning is always, to a certain extent, connected to practical action; the use of any instrument, therefore, in our field of action, is always intelligent, conceptually mediated use. This, in principle, applies both to the more mundane tools we use in our everyday lives and, at a more elaborate level, to the construction and use of experimental machines in the various scientific and technological practices. 'Pure' thought and action cannot be separated on the level of experimental science: our very reasoning in a counterfactual manner ends up being the condition of possibility of our intervention in reality (cf. above all Buzzoni 2008), both in common thought and, on a more elaborate level, in science.

In the intelligent use of tools, in any context, from the simplest and most immediate to the most complex, cognitive and motor elements of knowledge are always intertwined. The distinction in principle between common knowledge and scientific knowledge loses its meaning. However, in the last part of the text, I argued for a new way of understanding the relationship between the motor and cognitive elements of knowing, a way through which a difference of degree, and not of principle, between common and scientific thinking emerged. To this end, the reference to the functional mechanism described by M. Polanyi and founded on the distinction between subsidiary elements, mostly connected to the dimension of one's own body, and focal elements of knowing, which consist essentially in the conceptual formulation of a tacit knowledge that moves within and with our personal being, was useful. The reference to the Polanyian epistemology of the person has allowed us to consider the distinction between sensorimotor and cognitive aspects of knowing in a functional rather than ontological sense. It is up to the person to choose to move from a subsidiary awareness of those elements that are part of us and include, along with our body, the tools we assimilate to it, to a focal or direct awareness of them. The shift is always, in principle, possible, since it is not a question of overcoming the leap between two different, separate spheres, from an ontological point of view, but only of a change of outlook, functional to the context and situation in which the person is placed, in his or her daily activities, as in science. The personal and conscious decision to shift from one perspective to the other concerns all knowledge, even though, such a shift from the tacit to the explicit, or vice versa, is a fundamental requirement in the experimental sciences, rather than in everyday problem-solving.

The answer to the initial question on the representation of reality when we intervene on it through the intelligent use of tools highlighted the need to hold together the cognitive and motor elements of action-driven knowing. This need highlights a link between the plane of common knowledge and that of scientific knowledge. The only difference between these can only be a difference of degree, since when we represent reality, using certain tools in our daily practices, we hardly ever feel the need to change our perspective of analysis, passing, according to Polanyi's language, from a subsidiary view to a focal view of the particulars of that activity; the issue is quite different, however, for science, whose primary aspiration is to translate the tacit into the explicit as much as possible, in order to arrive at a knowledge that can be reconstructed by the entire community.[6]

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