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Studi

Systematic Knowledge Research. Rethinking Epistemology

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Abstract *Systematic Knowledge Research* is the approach used to (i) describe the specific characteristics of various forms of knowledge (such as e.g. conceptual and non-conceptual knowledge; explicit and implicit knowledge; knowing-how and knowing-that). It (ii) investigates the overlapping points among the various kinds of knowledge forms, and it (iii) elucidates the mechanisms of interpenetration among them. *Systematic Knowledge Research* (iv) grasps the dynamic of various forms of knowledge and their interplay, and (v) describes the practices and the manifestations of knowledge. *Systematic Knowledge Research* provides analyses and suggestions for modeling each of the five fields as well as their interconnections. Because of these objectives *Systematic Knowledge Research* is different from both the traditional theory of knowledge and the varieties of science studies and meets the current desideratum to systematically broaden and revise the territory of epistemology.
KEYWORDS: Knowledge Research; Epistemology; Types of Knowledge; Epistemic Cultures; Science Studies.

Riassunto *La ricerca sistematica sul sapere. Ripensare l'epistemologia – Systematic Knowledge Research* è il nome di un approccio adottato per (i) descrivere il profilo caratteristico di varie forme di sapere (per esempio, tra gli altri, il sapere concettuale e non-concettuale; il sapere esplicito e implicito; il sapere-come e il sapere-che). Questo approccio (ii) indaga le sovrapposizioni tra le diverse tipologie di forme del sapere e (iii) chiarifica i meccanismi della loro compenetrazione. La *Systematic Knowledge Research* (iv) coglie le dinamiche di varie forme di sapere, la loro cooperazione, (v) descrivendo le pratiche e i modi di manifestazione del sapere. La *Systematic Knowledge Research* propone analisi e suggerimenti per modellare ognuno dei cinque campi d'indagine sopra menzionati, unitamente alle loro interconnessioni. Perseguire questi obiettivi segna la diversità tra l'approccio della *Systematic Knowledge Research* da una parte e quello della teoria della conoscenza tradizionale e dei diversi tipi di *Science Studies* dall'altra. La *Systematic Knowledge Research* viene incontro all'aspettativa contemporanea tesa all'ampliamento e alla revisione sistematica del territorio dell'epistemologia.
PAROLE CHIAVE: Ricerche sul sapere; Epistemologia; Tipologie di sapere; Culture epistemiche; Studi sulla scienza.

Types and forms of knowledge and their taxonomy

Knowledge IS A BASIC WORD not only in connection with the current discussions of the *knowledge society*. Different forms of knowledge play an important role in people's lives. This is the case with everyday habits, customs, compe-

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tencies, and practices as well as in science, technology, and institutions of the modern civilized world. Therefore, the different forms of knowledge and in particular their interactions at the interface of human cognition, communication, and cooperation (which might be called the CCC-triangulation) deserve increased attention and should be analyzed and reflected on thoroughly. More precisely, knowledge plays a fundamental role in all processes of human perception, speech, thought, and action. The fluid function of the triangular relation between an individual, other persons, and the world always already involves and presupposes indispensable forms of knowing.[1]

The least reflection reveals how multifarious and how broad the meaning of the word "knowledge" is. Even beyond the domains of science, technology, philosophy, and the arts, the word crops up throughout everyday life and in the most various contexts. One need only think of phrases like, "knowing for certain", "knowing the score", "knowing how to size things up", "let him know", "knowing a hawk from a handsaw", "knowing how to dress oneself", "a knowing look", "knowing how things go", "knowing the thing to do", "knowing what counts as an argument", and countless others. The following brief taxonomy of knowledge forms marks out some of the principal distinctions between various different forms and concepts of knowledge.

This spectrum of forms of knowledge extends from everyday cases (e.g. knowing how to open a car door, or how to organize one's day) to cases of artistic knowledge (e.g. knowing how to depict something, or how to render something expressive – in dance, music, or painting) and to cases of scientific knowledge as well (e.g. knowing how to conduct a methodological investigation in the natural sciences, in mathematics, or in the social sciences).

► First, one must distinguish between a *narrow* and a *broad* concept of knowledge:

(a) The *narrow* concept of knowledge pertains to acts of cognition that are bound up with method-governed procedures and with justification, truth, rationalization, and demonstrability. Any instance of this sort of knowledge must be able to be discussed, must be communicable, tradable and intersubjectively verifiable. The sciences are paradigmatically characterized by such a concept of knowledge.

(b) The *broad* concept of knowledge signifies, on the one hand, (i) the abilities involved in adequately grasping what is going on and what various things (e.g. a gesture, an image, a sentence) are about. On the other hand (ii), it also pertains to the realm of basic human capabilities, competencies, abilities, skills, practices, and proficiencies. In this broad sense of the expression, knowledge is an inviolable component of the facticity of every human action, speech act, thought, and perception. This broad and foundational domain of knowledge is an entirely familiar element of both our everyday lives (e.g. our everyday practices and know-how) as well as the arts and sciences. In connection with physics, for example, talk of such broad knowledge might refer to one's competence to execute an observation, to construct an experimental procedure, to manipulate a mathematical model and to apply it to the world of physical objects and events. Without taking account of this *broad* sense of "knowledge" it is impossible to formulate a comprehensive theory of human perception, speech, thought, action, and cognition, much less a far-reaching and satisfactory epistemology.

► Our next step must be to make a heuristic distinction between various *forms* of knowledge, such as *everyday knowledge* ("knowing where the next mailbox is"), *theoretical knowledge* ("knowing that 2+2=4"), *practical knowledge* ("knowing how to steer an automobile"), and *orientational knowledge* ("knowing what one is to do (or forgo) in a given situation").

These various forms of knowledge are perfectly familiar. As a rule, we have a direct understanding of them. The aim of systematic and reflective knowledge research is to elucidate the peculiar profiles of knowledge forms as well as their interplay. But to do so requires various extensions, modifications, and revisions of traditional and contemporary epistemology. For we cannot understand the sense of

epistemological questions regarding validity, justification, and the limits of knowledge until we have established which forms of knowledge (and which modes of their interplay) are at issue in a given case. To this extent, knowledge research must precede epistemology proper, for the latter always presupposes the former. To risk a provocative formulation: epistemology is a branch of knowledge research, not the reverse.

Elucidating (a) the peculiar profile of various knowledge forms, (b) their points of overlap, and above all (c) the mechanisms of their interpenetration make up some of the fundamental tasks of comprehensive and systematic knowledge research. These tasks also mark out desiderata for an extended and revised epistemology.

Knowledge research and its objects

If one explicitly asks, against the background of what has been presented thus far, "what is knowledge research and what makes it so valuable?", my answer can be given as five interconnected themes and desiderata. Systematic and reflective knowledge research is concerned to (i) conceptually elucidate and describe the peculiar profiles of various forms of knowledge; (ii) identify and investigate the points of overlap between the various kinds of knowledge forms; (iii) elucidate the mechanisms of interplay and interpenetration between various forms of knowledge; (iv) grasp and model the dynamic of various forms of knowledge and their interplay; (v) describe the practices and the manifestations of knowledge. Knowledge research thus defines its field in terms of the objects of its investigation. It aims to provide descriptions, analyses, therapy, and suggestions for modeling each of the five fields and to elucidate the mechanisms of the respective processes, states, and phenomena. And this enterprise is principally valuable because it is primarily these mechanisms which support the fluent function of human perception, speech, thought, and action as well as the whole network of triangular relations between subject, other subjects, and world.

We can no longer conceive of our task as one of setting various forms of knowledge against one another, or presenting them as mutually exclusive – though it goes without saying that a closer view of each form of knowledge will also bring to light their several differences. But such differences arise even within a single form of knowledge. For example, within "scientific knowledge", we must distinguish between *mathematical*, *physical*, *technological*, and *computational* knowledge.

Needless to say, knowledge research, as we conceive it, is by no means limited to the study of science (which investigates the production and reception of the sciences). Along with scientific knowledge, our approach to knowledge research takes account of all the other forms of knowledge and sets them on an equal footing. Thus, systematic knowledge research is shifting from the traditional and vertical picture of a pyramid of forms of knowledge (with mathematics and sciences on top) to the picture of a spectrum of different forms of knowledge. Scientific knowledge is a tremendously important and well established form of knowing. But it is hardly the one and only such form, nor the only metaphysically respectable one. It is not at all difficult to bring out the central role of practical, moral, and aesthetic knowledge for our understanding of the world, others, and ourselves.

Moreover, it is of the first importance that we not reduce various forms of knowledge to a single form, as though there were *The One and Only Foundational Form of Knowledge*, and that we not seek out their common denominator in the hopes of reducing them to some third thing. In light of this irreducible plurality, and in the absence of a third term to serve as a common denominator, we are systematically (not just contingently) obliged to reject the view that there is ultimately just a single (e.g. scientific) perspective from which to consider epistemological questions and that everything that can be said about knowledge must be articulable from within that perspective. Yet I need hardly point out that this irreducible plurality does not by any means lead to relativism about knowledge forms. For there are strict

theoretical, practical, and everyday restrictions on the degree of this plurality. It would seem that not everything that presents itself as "knowledge" actually is knowledge – neither in the everyday, factical sense, nor in the theoretically grounded sense. We are just as subject to crises and breakdowns in everyday life as are our theories.

Knowledge research as a reflective, fundamental investigation

Knowledge research also becomes necessary whenever the intradisciplinary and intraphilosophical problematics we face (not to mention the social challenges that confront us) can no longer be defined or resolved in a purely disciplinary manner. In the face of such challenges, systematic knowledge research reveals itself to be a transdisciplinary, reflective investigative enterprise.[2]

Such intradisciplinary problematics can be seen in various new fields (which have in fact recently sprouted up in various disciplines, sciences, and technologies) – fields such as e.g. the transdisciplinary research across the board on *structures, processes, systems, materials,* or *imaging*.

Examples of such intraphilosophical problematics abound. Consider this one. To determine the nature of "consciousness" (or the "mind"), it does not suffice to merely list the findings of philosophy, cognitive science, neuroscience, psychology, computer science, linguistics, and other disciplines. The challenge rather consists in determining which subfields are so much as capable of contributing to answering the question.

Well known examples of social issues that call for transdisciplinary solutions are problems concerning energy, the environment, climate change, health care, the financial system, and education.

Against the horizon of such considerations, the fourfold moral of systematic and reflective knowledge research can be formulated quite economically. (i) It is the intraphilosophical, intradisciplinary, and intrasocietal *challenges* which call for the disciplines, theorems, reflections, and practices conducive to their solution, not the reverse. (ii) Systematic and reflective knowledge research can also have *direct* relevance for object-based studies and research. Its results can, for example, be integrated into the design of new experimental, theoretical, and reflective strategies and applied to existing systems and practices of knowledge and research or even incorporated into pedagogical approaches and teaching curricula. (iii) Knowledge research is a reflective discipline and, at the same time, a basic research program. (iv) Knowledge research is characterized by the discovery, development, and active shaping of pragmatic heuristics that are fundamental to our knowledge in both the narrow and the broad sense.

To the extent that knowledge research succeeds in accomplishing these tasks, it is capable of contributing to our orientation in everyday life, in the sciences, and in the arts. Indeed, helping to orient us in this manner constitutes a great deal of the *humane* significance of systematic and reflective knowledge research. But it should go without saying that such an approach also takes account of the *normative* aspects involved in the aforementioned processes, states, and phenomena. Knowledge of norms and one's orientation is of the utmost significance to knowledge research inasmuch as it affects the whole spectrum of forms of knowledge – from the broad, factical forms, to the more narrow, propositional ones.

Knowledge research in action: Four examples of interaction between different forms of knowledge

A taxonomy of forms of knowledge is comparatively easy to produce, and it may even be possible to establish broad agreement about its basic form fairly quickly. The mechanisms and practices by means of which forms of knowledge interact and interpenetrate one another, by contrast, remain altogether unexplored. Such mechanisms are, however, intimately familiar to us in as much as we encounter them in the practices of everyday life, sci-

ence, art, and knowledge. As a rule, they perform their functions fluently. Indeed it is only when they break down (or we are practicing philosophy) that we tend to explicitly ask questions about them at all. We principally come to realize how scanty our acquaintance with the mechanisms by which our forms of knowledge interweave and interact really is only after their acute breakdown and in the course of our attempts to reestablish their fluent functioning in our perception, speech, thought, and action. Indeed, it is primarily then that we come to appreciate their situatedness in our practices and lifeworlds. Systematic and reflective knowledge research views the elucidation of these mechanisms and practices as one of its foremost challenges. In the following, I wish to clarify the nature of this challenge by considering it in the light of four more tangible examples.

Example 1: Conceptual and non-conceptual knowledge

Knowing that the nearest mailbox is up by the next intersection means being in possession of propositional knowledge-that, and is a case of *conceptual* knowledge. Conceptual knowledge is bound to its articulation in a language and must be communicable in language. Both of these features are particularly manifest in scientific languages (e.g. in the language of physics), but they are also to be found in (and important to) ordinary language.[3]

Forms of *non-conceptual* knowledge include, for example, knowing how to open a car door, bake cinnamon bread, or ski, or knowing what it is like to have a sensation of color, or to feel jealous. The former variants of non-conceptual knowledge come from the realm of practical or procedural knowing-how. The latter variants belong to the realm of sensory-aesthetic experience and thus constitute a type of knowledge one can only acquire through firsthand experience, not simply pick up in a lecture hall or from a theoretical understanding of the phenomena.

Closer examination of our actual engagements with knowledge quickly shows that, in reality, we are by no means confronted with just a 'single pure' form of knowledge. The actual phenomena, processes, and states actually involved in our knowledge already involve a fusion of different forms of knowledge. It is only by means of *post factum* and *post phenomenon* heuristic reflection that we subsequently analyze the phenomena, processes, and states into distinct constituents. But the holism intrinsic to forms of knowledge can be heuristically differentiated as the interplay of conceptual and non-conceptual knowledge (indeed, any sufficiently fine-grained examination will reveal this holism within each individual form of knowledge, including conceptual or non-conceptual knowledge).

Examples of such modes of interplay and interpenetration are easy to adduce. Think, for example, of how a cellist must combine her *non-conceptual* aesthetic experience, her non-conceptual knowledge of tonal coloration and expression, her practical knowledge of how to manipulate her instrument with her *conceptual* knowledge of the structure and peculiarities of the notation and score of, e.g., György Ligeti's 1966 concerto for cello and orchestra.

Or one might consider the everyday situation of preparing a tasty meal. Here the cook has to combine his non-conceptual gustatory experience and his non-conceptual knowledge of the combination of ingredients with his explicitly conceptual knowledge of the cookbook recipe and the linguistic formulations of the instructions and rules it contains. It is only in combination of these components that saffron rice and marinated mango chicken can turn into a delicious dish.

Yet one could equally well consider what takes place in, say, the laboratory of an experimental physicist. In addition to her explicit *conceptual* knowledge of the theoretical setup of the experiment and of the hypothesis that is actually to be tested, *non-conceptual* capacities are also drawn on in performing the experiment itself. The latter might include the technical and practical operation of the material experimental apparatus (e.g. technological equipment and computers). But one would also have to include the capacity to visually read off

significant signs from the computer screen and, indeed, the whole range of non-conceptual knowledge of the tensile strength or permeability of the materials used in the experiment. And the latter forms of knowledge belong to our pre-intentional attitudes in coping with things and cannot be addressed as forms of conceptual, linguistic knowledge-that.

One might even consider how a competent speaker of English must combine her invariably non-conceptual knowledge and practical ability to speak with the conceptual knowledge of the semantic content of English words and sentences.[4] The example of the competent language user is especially fruitful in our context because we have here a situation in which the very linguistic capacities which constitute the basis of *all* conceptual knowledge (in the narrow sense) themselves clearly involve and presuppose non-conceptual dimensions. Non-conceptual knowledge is thus prior to and a condition of conceptual knowledge. The ability to follow a rule in speaking a language is (as Wittgenstein rightly insists) *not* to be understood as though competent speakers possessed some conceptual or theoretical knowledge of predetermined and fixed semantic rules and their content.[5] Now this conclusion naturally does not alter the fact that explicit conceptual knowledge can conversely affect and modify the non-conceptual competencies and abilities invoked in speaking a language.

Systematic knowledge research also calls for more fine-grained considerations of the modes of interplay between different variants of *conceptual* knowledge among themselves, as well as the modes of interplay between variants of non-conceptual knowledge. In the latter case, however, the mechanisms of interaction and interpenetration are virtually unknown. Nevertheless, we have no difficulty in giving examples of such modes of interplay from everyday life, or from the arts and sciences.

A simple but telling example of such interplay between different *conceptual* forms of knowledge in the sciences is the interaction of 'mathematical' and 'physical' knowledge in physics. Both forms of knowledge are conceptual, and their interaction has famously generated some of the greatest achievements of modern natural science.

The interplay of various *non-conceptual* forms of knowledge is an equally familiar feature of the arts and sciences as well as our everyday lives, though its mechanisms are still almost entirely unknown.

Non-conceptual forms of knowledge include, *inter alia*, perception (e.g. a perception of color), experience (e.g. of a personal and immediate passion), intuition (e.g. an immediate visual experience), and procedural, practical abilities or knowing-how (e.g. bike riding, swimming, or cello playing).

The question of how such non-conceptual forms of knowledge interact and interpenetrate one another then becomes a question of the mechanisms by which forms like "perception and knowing-how" or "experience and knowing-how" interact. An example of the first sort of interaction would be the interplay between a cellist's auditory perception (which is non-conceptual sensible knowledge) and the practical abilities the cellist exercises in playing her instrument (which is non-conceptual practical and procedural knowing-how).

Further examples can easily be generated by considering the interplay between bodily movements, sounds, and gestures (e.g. in ballet dancing). Brain surgery, for example, requires the surgeon to connect her view of the monitor (and thus her non-conceptual, visual knowledge) with her deft hand movements (and thus her non-conceptual, haptic knowledge) and to coordinate these with her experience (not least of all with the non-conceptual portions of her practice-based experiential knowledge) and still further forms of non-conceptual knowledge.

Example 2: Explicit and implicit knowledge

Knowledge always contains more than just what one knows, and we know more than we can say. Across the whole spectrum of knowledge forms – from basic, factical states of knowledge in practical situations to explicitly linguistic, propositional knowledge in the nar-

row sense – knowledge contains and involves, *inter alia*, abilities, competencies, contexts, background conditions, attitudes, goals, purposes, networks of beliefs, habits, habitualized patterns, and tacitly presupposed assumptions of somatic, neural, and physical processes (such as, for example, the activities of the central nervous system).

In knowing something, we needn't be explicitly conscious of any these components. Indeed, focusing one's attention on these components (not to mention completely articulating them in propositional form) can often disturb or even derail our capacity for explicit knowledge or our ability to successfully learn a technique or a practice (e.g. bike-riding, or cello-playing). In order to so much as have explicit and conscious knowledge of something, one must already presuppose and rely on a great deal of implicit, unspecified, and unconscious knowledge. Accordingly, we can choose to investigate either the particular profile of explicit knowledge, or that of implicit knowledge.

Michael Polanyi gives a well-known example of implicit knowledge.[6] I am hammering a nail into the wall. My conscious attention is (distally) trained wholly on the nail and the hammer. But there are many other components in play, of which I am not explicitly aware, but which are essential to my successfully hammering the nail into the wall – e.g. the motion of my hand, the placement of my fingers with respect to my palm, the pressure of my grip on the hammer's handle, and many other things. Thus, much implicit knowledge (in the broad sense) must already be in play in order for me to so much as act, or gain my orientation. But in many cases, this implicit knowledge must not become explicit at the moment of the action's execution (e.g. while I am swinging the hammer, or, in a scientific context, while a physical measurement is being performed). Otherwise I am far more likely to hit my thumb than the nail or even land myself in the emergency room.

These interconnections are just as characteristic of the everyday knowledge proper to our life-world as they are of our artistic or scientific knowledge. The ability to make discoveries presupposes precisely this relation of proximal and distal aspects of knowledge. Systematic and reflective knowledge research can thus be described as an attempt to analyze just this relationship between explicit and implicit knowledge in a way that is fruitful for questions regarding knowledge and epistemology. If all knowledge were explicit knowledge, then research and discovery would be impossible. Conversely, since research and problem solving clearly *are* possible, it cannot be that all knowledge is explicit knowledge.

It is important to me here – as both an epistemological and a methodological point – that the relation of implicit to explicit knowledge not be conceived as though implicit knowledge somehow unconsciously encapsulated a content that need only be made public and discursive. The contours and profile of explicit knowledge are simply different from those of implicit knowledge. In becoming explicit, something gets *added* to implicit knowledge. This transition involves, among other things, increased distal attention and cognitive determinacy (which is coupled with consciousness and, in cases of knowledge in the narrow sense, also coupled with communicability, evidence, justification, and methodological order). This point is very important to me. For in contemporary philosophical discussion, one all too often encounters the view that everything depends on making implicit knowledge explicit. Indeed, Robert Brandom's title "making it explicit" has become a veritable slogan in contemporary discourse.[7] The picture connected with this view strikes me as singularly ill-suited to capture or adequately describe the peculiar character and role of the interplay and interpenetration of various forms of knowledge in our actual perception, speech, thought, and action. And it is not just the processes proper to our everyday life-world that this conception fails to capture, it is equally incapable of grasping such modes of interplay in the sciences, and is utterly hopeless in approaching the arts.

Consideration of the interplay between implicit and explicit knowledge as well as the in-

terplay between the proximal and distal aspects internal to implicit knowledge can (as Michael Polanyi rightly claims) provide us with the means to understand what actually happens when knowledge is generated in a *creative* way.[8] So long as we do not begin by assuming that all knowledge is explicit, we can invoke the distinction between explicit and implicit knowledge (and their different internal constitutions) to resolve this paradox. For our conception of implicit knowledge as a kind of intermediary state between explicit knowledge and total ignorance can help us understand what happens when, by exercising her creative abilities, someone generates new knowledge. This opens up issues regarding the processes of generating, extending, modifying, and specifying our knowledge. Indeed, it serves to demonstrate that such processes are only possible against the background of knowledge that is as yet not explicit but rather unspecified and implicit. Systematic and reflective knowledge research investigates precisely this relationship between explicit and implicit knowledge.

Example 3: Distributed and integrated knowledge

Let us now consider the ways in which distributed and integrated forms of knowledge interact with and interpenetrate one another – a phenomenon with which we are intimately familiar both in everyday life, and in the arts and sciences. The following four scenarios should help to clarify the range of phenomena in question.

The apartment

Say that an apartment has sustained extensive water damage. Repairing such damage requires the interplay of altogether different experts and different forms of knowledge. The architect, electricians, plumbers, painters, construction workers, heating specialists, (and, if the apartment is under historical protection, restoration specialists) must all work together. What is necessary is a problem-oriented cooperation of various experts and of various forms of knowledge with the aim of restoring the apartment to a habitable condition. The embodied knowledge of any single worker would be insufficient to repair the damage: what is necessary is an integrative interplay of distributed forms of knowledge.

Driving a car

To successfully set a car into motion and steer it requires, *inter alia*, the technical-functional knowledge of what a steering wheel is and how the gear shift operates, a visual knowledge of the gas gauge and speedometer, practical knowledge expressed as the skillful hand movements required to operate the blinkers, the practical competency involved in using a GPS system. Moreover, we not only assume that one must be able to successfully integrate many of these forms of knowledge in order to count as a competent driver. We also accept that, though the automobile (or, say an "Airbus 380") itself constitutes a highly complex technical system of the most various technologies and forms of knowledge, the driver (or pilot) need not have all of this knowledge ready to hand at all times. In the rule, we simply rely on the fluent interplay of forms of knowledge, at least as long as their interaction continues to be frictionless and breakdowns are righted promptly.

The operation room

On what does the neurosurgeon rely in opening the brainpan of a patient and performing open brain surgery? Neurosurgeons tend to respond that they rely on their eyes and their view of the monitor (i.e. on the imaging process and, in this sense, on *pictorial* knowledge), on their practical skill or the knowing-how expressed in their deft and skillful hand movements, and on the knowledge gained through their long experience. A neurosurgeon's activities constitutively rely upon the integrative interplay of different forms of knowledge and each of her actions presupposes this interplay as a matter of course.

Laboratories

Any experimental laboratory or research lab showcases a complex interplay of various knowledge forms, practices, and dynamics. One need only ask an experimental scientist to learn how multifaceted their activities are. Experimental cultures can be described as constellations of interplay between distributed and integrated forms of knowledge, in which various knowledge forms, practices, and dynamics are trained on specific objects of investigation.

Example 4: Knowing-how and knowing-that

The abilities, practices, procedures, competencies, skills, proficiencies, and established habits signified by the expression "knowing-how" are intimately familiar to us. And this is true across the whole spectrum of our experience – from our everyday practices (e.g. knowing how to open a refrigerator) through our acquired skills and abilities (e.g. swimming or tying a necktie) to higher-level activities (e.g. knowing how to follow rules in speech, thought, and action, or knowing how to construct a mathematical proof).

Knowing-how is procedural knowledge, knowledge in action – it is not knowledge of fact or theoretical knowledge, and it is not primarily articulable in linguistic propositions. Rather, the cardinal features of knowing-how are the acquisition, refinement, and ultimate exploitation of one's competency in following rules. And that goes for higher-level competencies as well – even for competencies at the highest level – like the ability to speak a language, or reflect upon the conditions of the validity of rules and norms (e.g. of arithmetical rules, rules of everyday comportment, or moral and ethical rules).

Knowing how to maintain one's balance while riding a bike (or learning how to ride a bike) doesn't by any means require prior and explicit propositional knowledge of the corresponding physical laws, the appropriate angle of the handlebars, requisite pressure to apply with one's arms, the proper posture of one's upper-body, the coordination of foot and hand movements. If such knowledge did constitute a condition of the ability to ride a bike, only a few geniuses would possess the perfect comprehension of physics and mathematics involved in successfully riding a bike.

Rule-following – which is, for example, involved in the practice of successfully maintaining one's balance while riding a bike – does (or need) not involve following a rule which has been previously established through physical laws. It is rather *in virtue of* practice, training, guidance, practical demonstration and imitation that one can acquire and subsequently refine and exploit this ability, competency, or technique. It is something I have referred to in another context as the regularity bound up with the exercise of a practice – an "intra-praxis regularity" (as opposed to a "criterial rule").[9]

By way of conclusion, I would like to go a bit beyond the foregoing four examples of how various forms of knowledge can interact and interpenetrate and indicate just two consequences and theoretical desiderata that arise against the background we have sketched. In particular, I will discuss (section 5) the correlation of "forms of knowledge with forms of representation" and (section 6) the correlation of "knowledge forms with creativity".

Forms of knowledge and creativity

As we indicated in example 2 ("explicit and implicit knowledge"), reflection on the modes of interaction and interpenetration between different forms of knowledge can shed light on how radically new knowledge is created. One of the principle characteristics of creativity – both in everyday life, in philosophy, and in the arts and sciences – is the fact that it involves drawing on a number of different forms of knowledge in one's associations, thought, and experiments.

Recall, for example, one of the most creative transfers of one domain onto another: the application of mathematics to the realm of physical objects and events. As we mentioned earlier,

the mathematicization of natural science is one of the key presuppositions and greatest achievements of modernity – and one that continues to gain in importance. It is often the mathematical formalism and the relevant fundamental mathematical equations that first circumscribe and determine what even counts as a relevant object of physical investigation – an object that can subsequently be correlated with a mathematical model. In particular, what we have here is an interplay and interpenetration of mathematical and physical knowledge. For in each such case there is an explicit step involved in going from the mathematical formalism to its application to the domain of physical objects. And this simultaneously presupposes and relies upon the interplay of theoretical knowledge (knowing-*that*) and practical knowledge (knowing-*how*) of its appropriate *application*.

Cases of radical creativity – e.g. the groundbreaking scientific discoveries and artistic achievements of a Beethoven, Lobachevsky, Copernicus, Einstein, Cézanne, Picasso, Schönberg, Heisenberg, or a Michelangelo – involve processes which break with established rules, principles, and basic patterns fundamental to some system and replace them with new principles, rules, and patterns. Famous examples include: the transition to non-Euclidian geometry, Schönberg's break with tonal music, the transition from the linear to the circular notation of Kekulé's model of benzene.

In addition to identifying the psychological characteristics of creative people, one can also attempt to clarify and to describe (at least to a certain extent) the phenomenology of creative processes. This is no small job, but does belong among the tasks of systematic and reflective knowledge research, which shares certain aspects in common with the research on creativity. A minimal phenomenology of creativity would certainly have to include such aspects as the ability to venture to draw analogies between various forms of knowledge, and the ability to foster the interplay and interpenetration of different forms of knowledge and the forms of representation internally correlated with them.

So, here again we find ourselves faced with different forms of knowledge and different modes of their interpenetration. These two problematics form the heart of the whole endeavor called "systematic and reflective knowledge research". Against the background of the triangular I–We–World relation, the enterprise leads us to extend and revise epistemology. I have here proposed some first steps towards new territory. Now this territory needs to be discovered, mapped out, and populated. That is the desideratum. The seas are open.

Knowledge research and epistemology

As sections 1 to 4 demonstrated, knowledge research precedes epistemology as its necessary precondition. Against the background of this claim, I would now like to concentrate a little more on the relationship between knowledge research and epistemology.

Epistemology is not some closed field of study, whose principle themes and aspects have been determined once and for all. Yet as far as I can see, contemporary epistemology has thus far altogether failed to adequately train its attention on the different forms of knowledge or their dynamics, practices, or modes of interpenetration. I aim to make a case for doing just this. Now if what I urge is in fact plausible, it is easy to see that forms of knowledge (along with their mechanisms and modes of interpenetration) will not simply constitute new members of the existing epistemological realm. For to place such forms of knowledge at the center of our epistemological investigations calls for sweeping expansions and revisions of contemporary epistemology. And this entails that we can (and must) expand, shift, reexamine, and partly revise our conceptions of the *spectrum* of epistemological topics as well as our conception of *who* counts as an epistemologist. It seems to me that knowledge research calls upon us to proceed in a way that is coherent with contemporary epistemological conceptions even as we proceed beyond them.

Comprehensive knowledge research should reject the prevailing fixation on the Gettier

problem.[10] Large portions of epistemological debates have been held hostage by this problem for far too long. It has afflicted the literature with a certain Byzantine character. Moreover, the whole debate revolves around the *narrow* concept of knowledge as something one could give a definition of or criteria for. Knowledge is summarily characterized as *justified* and *true*, and all subsequent thought on the subject is limited to these two definitive conditions.

Yet even within the literature on this narrow concept of knowledge, some authors (e.g. Crispin Sartwell and Ansgar Beckermann) have viewed it as a central difficulty that the traditional concept of knowledge cannot simultaneously and satisfactorily embody both components (truth and justification). If both truth and justification are treated as equally necessary conditions, knowledge becomes an "illegitimate hybrid-concept". In keeping with this conclusion, the concept of knowledge itself would have to be abandoned as "incoherent".[11]

Yet, first of all, this suggestion runs contrary to our intuitions about knowledge. Inasmuch as we are able to successfully orient ourselves in the world and in relation to other people – that is, inasmuch as we are able to perceive, to speak a language, to think, to act and are able to exercise our various abilities – we are quite justified in our conviction that we possess basic, factical knowledge in the broad sense.

Second, even this suggestion has not yet freed itself from the stranglehold of the narrow, classical concept of knowledge. Methodologically speaking, the suggestion is just another conceptual analysis of knowledge, albeit one engaged in a further debate about what an adequate conceptual analysis is supposed to look like. Since, however, sections 1 to 4 have demonstrated that this *narrow* concept of knowledge cannot be the primary one, the whole mode of argument about this point is quite limited in its effect. It dissipates into nothing as soon as we shift our epistemological focus to the *broad* sense of knowledge and to the whole spectrum of various knowledge forms that regularly confront us in sciences, arts, and in everyday life.

The broad sense of knowledge – according to the thesis we have advanced here – is genealogically prior to the narrow sense and constitutes one of its necessary conditions, not the reverse. I described the broad sense of knowledge as a primordial and foundational state. This state is a facticity that is, in varying degrees, proper to human "Being-In-the-World" (Heidegger), to all intersubjectivity between persons, and to the world disclosed by such intersubjectivity. Such a state cannot be subsequently analyzed into various constituents.

I see here a certain family resemblance between the status of the broad concept of knowledge and the status that Peter Strawson seeks to reclaim for the concept of a person.[12] Like the concept of a person, the broad, basic, factical concept of knowledge cannot, strictly speaking, be the object of exhaustive conceptual analysis. For what is at issue in the broad concept of knowledge is precisely a non-reducible, non-analyzable concept, which rather serves as the basis for all conceptual analysis in the narrow sense, inasmuch as all conceptual analysis already presupposes and relies upon it.

In a certain sense, I share Timothy Williamson's view that knowing should be conceived as «the most general factive mental state».[13] More particularly, I share his view that knowledge is primordial in the sense that it neither must nor can be analyzed in terms of other concepts (as has traditionally been attempted using the concepts of "belief", "truth", and "justification"). All attempts to do so have failed. And the explanation of this failure is simple: «knowledge has no such analysis». Knowing rather serves to help us analyze and explain many other things, but «not as something itself to be explained». Such a view of the matter «reverses the direction of explanation predominant in the history of epistemology».[14] I wish to expressly endorse such a reversal of the direction of explanation in epistemology. In light of this reversal, reflective knowledge research might equally well be characterized as an attempt to describe and shed light upon this newly altered epistemological terrain. It is not an analysis of the concept of knowledge, as the lat-

ter has been traditionally characterized in terms of various theoretical constituents – justification, truth, belief.

It is an important aspect of the broad sense of basic, factical knowledge that this concept is deeply and firmly anchored in our everyday language, our life-world, and our ordinary practices. We are as intimately familiar with the language games associated with the concept as we are with its corresponding actions and practices. And in light of this fact, it makes good sense to ask whether the well-known classical proposals and the variants that arose as responses to difficulties with the classical proposals really exhaust our options here. One might well ask whether there might not be alternative theories of knowledge which are neither committed to the classical three-term model of knowledge (justified–true–belief) nor to the traditional methods of conceptual analysis.

The answer is twofold. First, there are important approaches in roughly this direction which afford points of connection as well as points of contrast with systematic and reflective knowledge research. A few examples are pragmatic theories of knowledge (e.g. Edward Craig's), naturalistic theories (such as Hilary Kornblith's), and formal epistemologies (such as Vincent F. Hendricks's).[15] Second, from an epistemological perspective, systematic and reflective knowledge research understands itself to be a contribution to the field of such novel orientations. At the same time, however, it brings certain aspects of knowledge into view that call for expansions and revisions of contemporary epistemology. The principal way in which knowledge research effects these changes is by freeing us from the exclusive dominance of the model of 'belief' and the traditional form of "autonomous justification".[16]

Systematic and reflective knowledge research can make important contributions in the context of epistemological methodology (and hence with regard to questions about the structure of the "epistemological justification of our beliefs" and questions regarding the "sources of epistemic knowledge"). The four most important methodological positions in contemporary epistemology are the follows.

► "Coherentism" signifies the position according to which the justification of a belief consists in its entrenchment in a lattice of other beliefs – i.e. in its relation to other beliefs. A prominent example of this position can be found in the work of Donald Davidson.[17]

► "Foundationalism" signifies the position according to which knowledge and justification rest upon a presupposed basis (e.g. of perceptions, or of self-evident beliefs), which forms the foundation for the generation of all (other) knowledge and epistemological justification. Aside from its 20th Century representatives like Roderick Chisholm, it is only natural to mention the classical locus of modern foundationalism – namely Descartes, in his search for a secure foundation for knowledge and justification.[18]

► "Pragmatism" signifies the position according to which every kind of knowledge (as well as all epistemological justification) can be traced back to and explained in terms of capacities for action and the effects of such actions. Prominent classical pragmatists include such figures as William James and Ludwig Wittgenstein, and today authors such as Edward Craig, Hilary Putnam, and Robert Brandom.[19]

► "Naturalism", in an epistemological context, signifies the position according to which "knowledge" is a "natural fact" and consequently an object of natural scientific investigation. Such scientific investigation is taken both to explain the generation of knowledge as well as to provide the requisite epistemological justifications. In contemporary debates naturalism is championed by numerous authors, most of whom champion either a physicalist or an evolutionary biological perspective. Prominent figures include Hilary Kornblith, Ruth Millikan, David Papineau, and Fred Dretske.[20]

Systematic and reflective knowledge research, with its focus on fundamental conceptual elucidation and on the interplay and interpenetration of various forms of knowledge, seeks to incorporate the positive aspects of each of these four principal methodological positions, yet without saddling itself with their at-

tendant difficulties. This is clearly an ambitious undertaking. What follows is a rough outline of the dimensions along which knowledge research seeks to align itself with, or decisively diverge from these prominent epistemological methodologies.

Coherentism

In the first place, the various forms of knowledge must, of course, be in frictionless agreement among themselves and also be able to sustain the fluent continuation of actual perception, speech, thought, and action. Yet the fluent functioning of knowledge forms is simultaneously subject to the conditions of empirical validity. By invoking such conditions, knowledge research neutralizes the danger that threatens traditional coherentism – namely the danger of descending into a groundless coherentism of beliefs, an involuted but vacuous ceremony of mere coherence.

Foundationalism

It is one of the fundamental assumptions of knowledge research that all manifestations of knowledge forms are connected to semiotic and interpretational functions. There is no knowledge without signs and interpretation. And this point holds equally well, whether one is speaking of knowledge in the broad sense (basic, factical knowing) or in the narrow sense (linguistic, propositional knowledge). Semiotic functions and corresponding interpretational functions suffuse the whole spectrum of knowledge forms. These functions are manifest in the practices, dynamics, and modes of interpenetration proper to various forms of knowledge – indeed, if they were *not* so manifest, we could not even bring into view specific and individuated forms of perception, speech, thought and action, nor could we recognize an experience or a representation as actual. In this sense, the semiotic and interpretational functions are fundamental to our forms of knowledge and their modes of interplay. But they are not fundamental in an ultimate and metaphysical sense, but rather in a pragmatic sense. Thus, for example, semiotic and interpretational functions are, for their own part, culturally and historically conditioned; they are modifiable, alterable, revisable, temporal. In a word, they constitute our *pragmatic* semiotic and interpretational foundations *for the time being*.

Pragmatism

Reflective knowledge research agrees with the pragmatist that the sources of knowledge and its justification are not to be sought in some realm of theoretical propositions or in their inferential relations. Knowledge research rather seeks these sources in the fact that we are minded creatures who can *act* – i.e. in the fact that we are agents in the world who are active in relation to the world, to other people, and to ourselves. Such actions are essentially involved in the facticity of the I–We–World triangle. To this extent, actions as well as procedural and practical abilities, capacities, and competencies are of the utmost relevance to epistemological methodology. But critical knowledge research does not go on to commit what I would like to call the practice-centric fallacy, which consists in the further claim that knowledge is *nothing but* the performance of practical skills and which maintains that knowledge can ultimately be equated with actions. No such equation is possible (or even intelligible) with respect to *either* of the two senses of knowledge we have distinguished – the broad sense of basic, factical knowing, or the narrow sense of propositional knowledge.

Knowledge can indeed be conceived as a mental state or process that both depends on action and disposes one to act. (This would enable and require us to distinguish knowledge from other mental states such as remembering, or being convinced of something.) But it simply does not follow from this that knowledge can be *equated* with action. Accordingly, reflective knowledge research by no means seeks to reduce theoretical knowledge-that to practical or procedural knowledge-how, or to derive the former from the latter. It is true that a particu-

lar piece of knowledge can be individuated in terms of its practical and action-initiating consequences or effects, and that these effects enable us to evaluate and examine it in light of our praxis. But this clearly does not mean that knowledge and action are the same. It rather points up the necessity of a unified theory of knowledge and action.[21]

Naturalism

Systematic and reflective knowledge research does indeed advocate a *naturalization* of knowledge (viz. of knowledge forms). That is, it urges us to view forms of knowledge as natural phenomena in the basic sense that they belong to us as human beings. But knowledge research avoids the danger of scientistic reductionism. For knowledge research does not assume that the *scientific* form of knowledge is the only essential and metaphysically respectable form. In place of the aforementioned old view on forms of knowledge as constituting a pyramid (with scientific knowledge at its pinnacle) knowledge research recommends viewing different forms of knowledge as distributed along a spectrum and inside the space of forms of knowledge. Moreover, it underscores the fact that all our knowledge (and any interplay between knowledge forms) will be physically underdetermined. We can be sure that the underdeterminacy at work here is strictly ineliminable, because forms of knowledge are, at all times and in all places, exercised and articulated in and through semiotic and interpretational functions. And the semantic and pragmatic features of such functions systematically (not just contingently) elude all attempts at physical reduction. There simply could not *be* knowledge-signs that were not physically underdetermined. Or, formulated differently: the proposition that there are non-underdetermined signs is itself not free of underdeterminacy.

Notes

[1] This article is a selected and shortened reprint of some passages from G. ABEL, *Knowledge-Research: Extending and Revising Epistemology*, in: G. ABEL, J. CONANT (eds.), *Rethinking Epistemology,* vol. I, W. De Gruyter, Berlin-Boston 2012, pp. 1-52 – Translation from German by Daniel Smyth. See also G. ABEL, *Forms of Knowledge: Problems, Projects, Perspectives*, in: P. MEUSBURGER, M. WELKER, E. WUNDER (eds.), *Clashes of Knowledge. Orthodoxies and Heterodoxies in Science and Religion*, Springer, Dordrecht 2007, pp. 11-33.

[2] In speaking of "transdisciplinarity" I am invoking the use of this term that Mittelstraß introduced into the literature. See J. MITTELSTRAß, *Transdisziplinarität – wissenschaftliche Zukunft und institutionelle Wirklichkeit*, UVK, Konstanz 2003.

[3] My descriptions of both example 1 ("conceptual and non-conceptual knowledge") and example 2 ("explicit and implicit knowledge") are indebted to discussions and considerations raised in the context of my research group at the "Innovationszentrum Wissensforschung (IZW) / Berlin Center for Knowledge Research" at the TU in Berlin (cf. www.wissensforschung.tu-berlin.de). These discussions were instrumental in preparing for the colloquium "Das Wechselspiel der Wissensformen: begriffliches und nicht-begriffliches, explizites und implizites Wissen" ["The Interplay of Knowledge Forms: Conceptual and Non-Conceptual, Explicit and Implicit Knowledge"] held in Berlin, July 8-9, 2010. I would like to thank the members of this group, and in particular express my gratitude to Stefan Tolksdorf, Claudio Roller, Doris Schöps, and Peter Remmers.

[4] See M. DEVITT, *The Ignorance of Language*, Oxford University Press, Oxford 2006.

[5] On the issue of rule-following see L. WITTGENSTEIN, *Philosophische Untersuchungen* (1953), Suhrkamp, Frankfurt a.M. 1984, §§ 198-242, and the contributions to the volume A. MILLER, C. WRIGHT (eds.), *Rule-Following and Meaning*, McGill-Queen's University Press, Ottawa 2002.

[6] M. POLANYI, *Personal Knowledge. Towards a post-Critical Philosophy*, Martino Fine Books, New York 1964, p. 55f. and p. 174f.

[7] See R. BRANDOM, *Making It Explicit: Reasoning, Representing, and Discursive Commitment*, Harvard University Press, Cambridge (MA) 1994.

[8] M. POLANYI, *Personal Knowledge*, cit., p. 127ff.; see G. ABEL, *The Riddle of Creativity: Philosophy's View*, in: P. MEUSBURGER, J. FUNKE, E. WUNDER (eds.), *Milieus of Creativity. An Interdisciplinary Approach to Spatiality of Creativity*, Springer, Dordrecht 2009, pp. 53-72.

[9] For more details about such a conception of "knowing-how" and its relation to rule-following, see G. ABEL, *Knowing How. Indispensable But Inscrutable*, in: S. TOLKSDORF (ed.), *Conceptions of Knowledge*, W. De Gruyter, Berlin-Boston 2001, pp. 245-267.

[10] See E.L. GETTIER, *Is Justified True Belief Knowledge?*, in: «Analysis», vol. XXIII, n. 6, 1963, pp. 121-123.

[11] See A. BECKERMANN, *Zur Inkohärenz und Irrelevanz des Wissensbegriffs. Plädoyer für eine neue Agenda in der Erkenntnistheorie*, in: «Zeitschrift für philosophische Forschung», vol. LV, n. 4, 2001, pp. 571-593; C. SARTWELL, *Why Knowledge is Merely True Belief*, in: «The Journal of Philosophy», vol. LXXXIX, n. 4, 1992, pp. 167-180.

[12] See P. STRAWSON, *Individuals. An Essay in Descriptive Metaphysics*, Routledge, London-New York 1959, ch. 3.

[13] T. WILLIAMSON, *Knowledge and its Limits*, Oxford University Press, Oxford 2000, p. 33ff.

[14] *Ibidem*. However, Williamson does not place the basic form of knowledge in the broad sense at the center of his considerations. He is rather focused upon the narrow kind of knowledge which is linguistic and propositional. In granting the crucial prominence to what I call the *narrow* sense of knowledge, Williamson threatens to reverse the proper genealogy between the broad and the narrow senses of knowledge. I have discussed this difference between Williamson's view and my own with reference to cases of knowing-how in G. ABEL, *Knowing How. Indispensable But Inscrutable*, cit.

[15] See E. CRAIG, *Was wir wissen können. Pragmatische Untersuchungen zum Wissensbegriff*, Suhrkamp, Frankfurt a.M. 1993; E. CRAIG, *Knowledge and the State of Nature: An Essay in Conceptual Synthesis*, Oxford University Press, Oxford 2002; V.F. HENDRICKS, H. ARLÓ-COSTA, J. VAN BENTHEM (eds.), *Readings in Formal Epistemology*, Cambridge University Press, Cambridge 2011.

[16] "Epistemic autonomy" is defined by Thomas Grundmann as follows: «a subject is epistemically autonomous just in case she is capable of determining which of her beliefs are justified (i) completely on her (independently from external authorities), (ii) independently of any empirical views about the world, and (iii) on the strength of purely rational considerations» (see T. GRUNDMANN (Hrsg.), *Erkenntnistheorie. Positionen zwischen Tradition und Gegenwart*, Mentis, Paderborn 2003, p. 17). Both foundations of the classical theory of knowledge (*a priori* knowledge and the autonomy of the subject) have notoriously come under attack from various different directions. They have quite rightly come to seem rather questionable. The reaction in epistemology to these attacks was split: philosophers either proclaimed the collapse and the end of the theory of knowledge or switched from the level of substantial epistemic theory to the level of "metaepistemology" by shifting their focus to the clarification of the *meanings* of epistemic concepts, and, in particular, the establishment of necessary and sufficient conditions for knowing (see R.A. FUMERTON, *Metaepistemology and Skepticism*: *Studies in Epistemology and Cognitive Theory*, Rowman & Littlefield, London 1995). This was and remains today the preferred path in broad swaths of analytic epistemology. Though I consider this move to the metaepistemological level to be an intellectually interesting move, it is still just a way of running away from the real problem. It is a stance that prefers armchair philosophizing to grabbing the bull by the horns and turning to investigate the mechanisms by which our various knowledge forms, their dynamics, modes of interpenetration, and practices actually function. Systematic and reflective knowledge research takes this latter route. In this context, to speak of "revisions" as I just have does not just serve to distinguish our enterprise from the traditional justificatory paradigm. The distinction runs much deeper, for it pertains to the very domain, the focus, and the architectonic of the whole epistemological enterprise itself.

[17] See D. DAVIDSON, *A Coherence Theory of Truth and Knowledge* (1987), in: D. DAVIDSON, *Subjective, Intersubjective, Objective*, Oxford University Press, Oxford 2001, pp. 137-158.

[18] See R.M. CHISHOLM, *The Foundations of Knowing*, Minnesota University Press, Minneapolis 1982; R. DESCARTES (1641), *Meditationes de Prima Philosophia*, hrsg. von G. SCHMIDT, Reclam, Stuttgart 1986.

[19] See W. JAMES, *Pragmatism* (1907), The MIT Press, Cambridge (MA) 1979; L. WITTGENSTEIN, *Philosophische Untersuchungen*, cit.; E. CRAIG, *Was wir wissen können. Pragmatische Untersuchungen zum Wissensbegriff*, cit.; H. PUTNAM, *Pragmatism. An Open Question*, The MIT Press, Cambridge (MA) 1995; R. BRANDOM, *Between Saying and Doing: Towards an Analytic Pragmatism*, Oxford University Press, Oxford 2008.

[20] H. KORNBLITH, *Knowledge and Its Place in Nature*, Oxford University Press, Oxford 2002; F.

DRETSKE, *Naturalizing the Mind*, The MIT Press, Cambridge (MA) 1995; R.G. MILLIKAN, *Language, Thought, and Other Biological Categories*, The MIT Press, Cambridge (MA) 1984; D. PAPINEAU, *Philosophical Naturalism*, Blackwell, Oxford 1993.

[21] For further suggestions in this direction see G. ABEL, *Sprache, Zeichen, Interpretation*, Suhrkamp, Frankfurt a.M. 1999, ch. 13.