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Tacit Mechanisms and Heuristic Theorizing:
Comments on Ryszard Wójcicki's "Is There Only One Truth? An Introduction to the Pragmatic Theory of Knowledge Acquisition"*

My aim in this paper is to develop a preliminary typology of subconscious, tacit mechanisms that underlie the conscious exercise of practical skills as well as the formation and functioning of conscious mental representations such as perceptual experiences, mental images, explicitly held beliefs and explanatory hypotheses. With this typology in hand, I consider whether these tacit mechanisms — or at least some of their aspects — can be examined and explicated by what Ryszard Wójcicki calls *heuristic theorizing* or *heuristic reasoning*.

My paper consists of two parts. In section 1 I outline the general structure of what Michael Polanyi calls *personal knowledge* or *tacit knowing*. I also discuss a few examples of tacit knowing and argue that they all have to be explained in terms of *implicit mechanisms* rather than in that of *implicitly held beliefs*[1] or *theories*. In section 2 I claim that despite having the same structure, the implicit mechanisms under consideration fail to form a homogeneous class: some of them operate on tacitly held beliefs and theories, whereas others involve *non-propositional* rather than *propositional*

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[1] Here and throughout this paper I take beliefs to form a subclass of propositional attitudes, *i.e.* of mental states equipped with propositional content.

representations; there are also implicit mechanisms whose characteristic feature is their using specific processing rules. In other words, what Polanyi calls personal or tacit knowledge may take either the form of representational states — propositional or non-propositional — or that of processing rules. Finally, I put forth a hypothesis according to which these and similar differences are significant for understanding the role of *heuristic theorizing* in the acquisition and justification of objective knowledge.

1. TACIT KNOWING: ITS STRUCTURE AND VARIANTS

1.1. The functional structure of tacit knowing: *Subsidiaries*, *focal targets* and *tacit integration*

Following Michael Polanyi, I assume that the function of what he calls *personal* or *tacit knowing* is to *integrate* the items that an agent is *subsidiarily* aware of into his *focal* awareness of what he is currently doing, perceiving or thinking of. Among the subsidiary items that may play a role in the processes of tacit integration are proximal or distal stimuli, tacitly held beliefs and theories, memories, cognitive schemas, superstitions, background assumptions, tacitly held general preconceptions concerning the nature of reality, and so on. It is worth stressing that to say that an agent is subsidiarily aware of a certain item is not to say that the item is consciously available to the agent. An item is a subsidiary in virtue of its function, that is to say, in virtue of the role it plays in the process of implicit integration.

In short, the agent's personal knowledge is nothing but his tacit ability to pick up certain subsidiaries and integrate them into his focal awareness of what occupies his practical, perceptual or cognitive attention.

According to Polanyi, the "relation of a subsidiary to a focus is formed by the *act of a person* who integrates one to the other" (Polanyi, Prosch 1975, p. 38). In my view, however, the integration in question is better viewed as a cognitive *process* rather than as a cognitive *act*. The point is, namely, that in many cases tacit integrating takes place at the sub-personal level of information processing, where there is no room for personal acts. Let us assume, therefore, that there is a difference between cognitive *acts* and *mere processes*: to call a cognitive process the *act of a person* is to say that it takes place at the personal level of information processing.

1.2. Varieties of tacit knowing

The processes of tacit integration result in the coordination of the agent's (*a*) practical, (*b*) perceptual and (*c*) cognitive tasks. Let me illustrate this claim with a few examples.

(*a*) **Tacit integration in action**

(a_1) Consider, following Michael Polanyi, an agent who drives a nail with a hammer. What the agent is subsidiarily aware of are tactile feelings in the palm of his hand; nevertheless, rather than focusing his attention on his feelings, the agent is focally aware of his driving the nail (see Polanyi, Prosch 1975, p. 33). That is to say, his focal awareness or, more accurately, his conscious coordination of action relies on his subsidiary awareness of his tactile feelings or sensations.

(a_2) Next, consider a tourist who has lost his way in a foreign city and tries to get to his hotel. He looks around and after a moment of hesitation turns left and goes down the main road. After a fifteen minute wandering around the city he can see his hotel. How is it possible? Assume, first, that some aspects of the neighbourhood look familiar to him. He recognizes that the remote tower he can see on his left is the cathedral belfry. On his right he can see a wide river. Assume, next, that his mind is equipped with a cognitive schema that represents the layout of the city. In short, the tourist integrates his subsidiary awareness of the tower, the river and the cognitive schema into his focal awareness of his action.

(*b*) **Tacit integration in perception**

(b_1) Consider a researcher who looks through a microscope and reports that two types of bacteria colonies have appeared on the agar plate. According to Ludwik Fleck — from whom I borrow this example — the researcher is able to recognize "the two types of colony at first glance, without any analysis or hypothesis" (Fleck 1979, p. 90). Note, however, that what underlies the researcher's "readiness for stylized (that is, directed and restricted) perception" (Fleck 1979, p. 84) is an unconscious integration of subsidiary stimuli into a consciously experienced whole. That is to say, the researcher's focal awareness of a given colony type relies on his subsidiary awareness of the relevant stimuli — proximal or distal — registered by his eyes as well as on his tacitly held typology of bacteria colonies.

(b_2) Consider, next, a native English speaker's ability to recognize grammatical English sentences in a flash. In other words, language perception — a process whereby one identifies the type to which a given linguistic token belongs — involves no explicit reasoning. Note, however, that the speaker is subsidiarily aware of his relevant auditory sensations and, consistently, of the burst of sound produced by his interlocutor. That is to say, language perception involves a process of tacit integration that results in the formation of a *linguistic percept*. The percept represents its corresponding linguistic stimulus in terms of its phonetic, lexical and grammatical properties, thereby identifying the sentential type the stimulus is a token of.[2] One can also suppose that among the subsidiaries that play an important role in the linguistic percept formation are the phonetic and grammatical rules of the English language (or of the speaker's idiolect). I will consider this issue in due course.

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[2] It is worth stressing that language perception as such does not determine the semantic interpretation of the token (see Fodor 1983, p. 88-89).

(b_3) Consider a diagnostician who explores a body cavity with a probe (see Polanyi, Prosch 1975, p. 35-36). Operating the device, he relies on his subsidiary awareness of the feelings in the palm of his hand. In this respect, the case under consideration is similar to that of the agent driving a nail. Note, however, that the diagnostician uses the probe to find out what is inside the cavity. That is to say, his focal awareness is perceptual rather than purely practical. His perceptual attention is focused on the objects he touches with the probe rather than on the tool itself. Note that the probe functions as one of the subsidiaries that tacitly bear on the diagnostician's focal awareness of the objects hidden in the cavity. It can be said, therefore, that experienced diagnosticians can have direct tactile perceptions of what they examine with their diagnostic tools.[3]

(*c*) **Tacit integration in cognition**

(c_1) Ask an agent to imagine two colour circles — blue and yellow — and to think of them as two filters or light beams that are moved closer together until they overlap; next ask him to report what colour he can "see" in his mind eye at the overlapping part. According to Zenon Pylyshyn — from whom I borrow this example (see Pylyshyn 2003 and 2007) — the agent's answer will reflect his tacitly held theory of colour mixing. In most cases the theory would be false, since few people are aware of the difference between additive and subtractive colour mixing. No matter whether true or false, it plays a tacit role in the agent's imagination. That is to say, it functions as a subsidiary in the process of tacit integration whose results are the mental images the agent is focally aware of.

(c_2) Finally, let us say a word on hypothesis-seeking procedures that tacitly underlie scientific *discovery* (see Polanyi and Prosch 1975, p. 57-65). Historical studies suggest that normally the procedures operate on subconsciously held metaphysical assumptions, hitherto accepted theories and general preconceptions concerning the nature of the reality. That is to say, hypothesis seeking is like an act of creative imagination that can be described in terms of tacit integration of various cognitive subsidiaries.

1.3. Implicit mechanisms or implicit beliefs? On propositional and non-propositional subsidiaries

I claim that all the variants of tacit knowing discussed above are best understood as involving implicit mechanisms rather than implicitly held beliefs or theories. The point is, namely, that many forms of tacit integration do not take beliefs or theories as their subsidiaries. Nevertheless, they all involve the operation of tacit mechanisms. Let me go into details.

Undoubtedly, implicit beliefs and theories do play a subsidiarily role in such cognitive tasks as (c_1) mixing colours in one's mind and (c_2) seeking explanatory hy-

[3] A similar point can be made on a blind person who uses a stick to explore his surroundings.

potheses. That is to say, the phenomenal character of an agent's mental image of overlapping colour circles relies on the agent's tacitly held theory of colour mixing. By the same token, the hypotheses that a researcher puts forth in order to explain certain experiential data relies on the researcher's tacitly held metaphysical beliefs and his general, though not necessarily explicated preconceptions concerning the nature of the reality, that jointly provide a base for drawing fruitful analogies. In short, (c_1) operating mental images and (c_2) seeking explanatory hypotheses are cognitively penetrable processes, that is, they are sensitive to what the subject believes, expects and desires. The agent who is subsidiarily aware of the difference between additive and subtractive colour mixing is likely to form an image that is different in content from that formed by the agent who is unaware of this difference. By analogy, researchers who work within traditions shaped by different metaphysical ideas and cognitive habits are likely to put forth different hypotheses explaining the same region of their experience. It is also worth noting that both (c_1) operating mental images and (c_2) hypothesis-seeking are highly attentional, painful and relatively slow processes. One can suppose, therefore, that they engage our general intelligence, that is to say, they involve general rules of reasoning that can operate on representations equipped with propositional contents.

By contrast, the integration that underlies the skilful and automatic performance of practical tasks does not seem to rely on tacitly held beliefs and theories. What underlies driving a nail with a hammer — see example (a_1) discussed above — is a complex mechanism that takes as its subsidiaries signals coming from the agent's senses and, probably, a kind of *topographic* cognitive schema representing those properties of the hammer that are relevant to the current task. The mechanism computes the location of the nail as well as that of the hammer and produces direct instructions for the motor-control system. What is more, the computation it performs is a subconscious, effortless and fast process that is insensitive to what the agent tacitly believes and desires. That is to say, it can hardly be regarded as a kind of implicit reasoning that takes propositional contents as its premises.

Consider, by analogy, example (a_2) discussed above. One can suppose that it calls for a different explanation than the one offered for example (a_1). The tourist's complex action is not automatic, requires much attention and effort. Its underlying integration, therefore, seems to involve a kind of implicit reasoning. What it does involve, I think, is *spatial reasoning*. Its characteristic feature is that it does not operate on propositional attitudes — beliefs, desires and expectations — but on what can be called *locating experiences* and *topographic cognitive schemas*. Let me explain my point.

The tourist's spatial reasoning operates on subsidiaries that cannot be reduced to the feelings or signals coming from his senses. Rather, what play a role in the integration under discussion are his conscious perceptual experiences: that of the distal cathedral tower and that of the river flowing through the city. But experiences are not beliefs and the representational content of an experience cannot be reduced to the propositional content of a belief. Adopting John Perry's terminology, one can call the experience of the cathedral tower and that of the river *locating representations*.[4] Roughly speaking, locating representations are cognitive states whose content can be represented by means of the formula of the form "*X* is *P*", where "*X*" is a demonstrative expression and "*P*" is a predicate ("*This* is the cathedral belfry", for example). According to Perry, locating representations play a crucial role in the cognitive processes that link perception to action or, in other words, in the process whose function is to adapt one's behaviour to one's perception. Taking into account the specific function they perform in spatial reasoning, I propose to call them *locating experiences*. Another subsidiary that plays a role in the integration under discussion is a topographic cognitive schema — a kind of mental model — representing the layout of the city.

Roughly speaking, the tourist's spatial reasoning takes his locating experiences and the topographic schema as its inputs and has another locating experience as its output. The content of the resulting experience — the one that the tourist is focally aware of — can be expressed by means of the sentence "*This* street leads to the hotel". The tourist is also subsidiarily aware of his "input" locating experiences as well as of his topographic schema. Note, nevertheless, that the tourist does not have to be consciously aware of the topographic schema that plays a subsidiary role in his spatial reasoning. Being able to see where the cathedral tower and the river are, he comes to the conclusion that it is *this* street that leads to the hotel. In short, the implicit mechanism that underlies spatial reasoning operates on tacitly held cognitive schemas and locating experiences rather than on tacitly held beliefs.

It remains to be examined whether the integration that underlies the formation of conscious perceptual experiences relies on what the agent tacitly believes, expects or desires. My hypothesis is that perception is like action in that it does not take tacitly held beliefs and theories as its subsidiaries. Rather, perceptual identification integrates the signals coming from sensory receptors and, next, uses its characteristic cognitive schemata to classify and interpret the integrated signals.

Consider example (b_1) first. One can suppose that what explains the experienced researcher's ability to recognize the type of bacteria colony at first glance is the fact that he tacitly holds a theory that determines the necessary and jointly sufficient conditions for belonging to the type. According to Ludwik Fleck, however, such a hypothesis seems to be highly improbable (see Fleck 1979, p. 90-92). Let us, therefore, consider an alternative hypothesis according to which the mechanism that mediates the recognition of the type of colony is two-stage. The first stage is what is usually called "early vision": it computes the size, shape, location, distribution and colours of the distal stimuli, thereby forming its *percept* (see Fodor 1983, p. 86-97). The second stage consists in classifying the resulting percept in respect of distance from the

[4] Admittedly, Perry speaks of locating *beliefs* rather than of locating *experiences*. Nevertheless, this terminological difference can be ignored as irrelevant (see Perry 1979 and Pylyshyn 2007, p. 18-19).

prototypes stored in memory. Consequently, we can speak of two types of tacit integration: the first one takes as its subsidiaries the signals coming from senses and, making use of the processing rules built into the functional architecture of the early vision system, produces the focal awareness of percepts conceived as early perceptual representations; the second stage takes percepts as its subsidiaries and results in fully-fledged perceptual recognition. Note that none of these mechanisms operates on beliefs. Admittedly, the experienced researcher can be said to hold an implicit typology of bacteria colonies. The typology, however, does not take the form of implicit theory; rather, it is best understood as a network of prototypes that make up a classificatory cognitive schema.

Consider, by analogy, example (b_2). In my view, language perception does not involve the second stage discussed above. Note, namely, that the process of early linguistic analysis results in the formation of what can be called a *linguistic percept*. Linguistic percepts represent distal verbal stimuli — that is, sentence tokens produced by speakers — in terms of their phonetic, lexical and grammatical properties only (see Fodor 1983, p. 88-89). In other words, the function of language perception is to determine the type-identity of every sentence token that is being processed.

One can suppose, however, that among the subsidiaries that play role in linguistic analysis are propositions that explicitly represent the grammatical rules of the agent's language. To know a language — one can say — is to tacitly hold the set of propositions specifying its rules.[5] According to Jerry Fodor, however, this assumption is neither probable nor necessary. What we need in order to account for language processing is the idea of a linguistic system that performs its operations in accordance with its characteristic rules. Nevertheless, the rules do not need to be explicitly represented. Rather, they are supposed to be built in to the system's functional or computational architecture; the architecture, let us add, that probably reflects the structure or arrangement of the system's neural implementation.[6] In short, explaining language perception we can do without the idea of explicitly represented rules that function as subsidiaries. Let us assume, rather, that the built-in rules are *functional* or *architectural subsidiaries*, that is, subsidiaries that make up the mechanism's functional architecture.

Finally, consider example (b_3): a diagnostician examines a cavity with a probe and comes to realize what is going on inside the patient's body. Let us distinguish between two representations that the diagnostician can be focally aware of: (*i*) a percept that represents the object to be found in the cavity in terms of its shape, location and size, and (*ii*) a more refined perceptual experience that classifies the object as belonging to a certain category. The diagnostician's focal awareness of representation (*ii*) relies on his subsidiary awareness of representation (*i*). The process that re-

[5] According to Fodor (1983, p. 3-10), the idea of language as a body of implicitly held or *cognized* propositions traces back to Noam Chomsky.

[6] The same is true of the processing rules underlying early vision.

sults in the formation of representation (*ii*) constitutes the second stage of perceptual identification and as such makes use of a classificatory cognitive schema conceived as a network of prototypes stored in the diagnostician's memory. The first stage of perceptual identification — the one that results in the formation of representation (*i*) — takes as its inputs the diagnostician's tactile sensations. The sensations, however, are not the only subsidiary factors that play a role in the first stage of perceptual identification. To form representation (*i*), it seems, the diagnostician's mind makes use of two topographic cognitive schemas. The first one represents the cavity's anatomy, whereas the second schema represents the diagnostician *extended body*, that is, his *body equipped with the probe*. Note that these two topographic schemas are ready to be used in spatial computations whereby the diagnostician's mind determines the location, size and shape of objects hidden in body cavities.

Let me summarize the results of the discussion. All the variants of tacit knowing involve mechanisms whereby the mind integrates subsidiary items into focal targets. Note, however, that only cognitive tasks (c_1) and (c_2) — that is, respectively, operating mental images and seeking explanatory hypotheses — can be regarded as involving the implicit integration of tacitly held propositional representations: beliefs and theories. All the examples of practical and perceptual tasks can be accounted for without making reference to such *cognitive* or *propositional* subsidiaries. The kinds of implicit integration that mediate and coordinate action and perception operate on *non-propositional* subsidiaries such as: (*i*) *sensory signals* coming from receptors (examples from (a_1) to (b_3)), (*ii*) *processing rules* making up the functional architecture of early perceptual analysers (example (b_2)), (*iii*) *topographic cognitive schemas* ready for use in spatial reasoning (example (a_2)) or spatial sub-personal computations (examples (a_1) and (b_3)), (*iv*) *classificatory cognitive schemas* conceived as networks of prototypes ready for use in perceptual identification (examples (b_1) and (b_3)), and (*v*) *locating experiences* whose content cannot be reduced to that of propositional attitudes (example (a_2)).

Note that such cognitive tasks as operating mental images and scientific theorizing are likely to be evolutionary younger mental functions, whereas the ability to perform practical and perceptual tasks — even those involving spatial reasoning and classification by prototypes — seems to be common to most animals. No wonder, then, that these more primitive, though very sophisticated abilities do not engage the complicated machinery of propositions and logical reasoning.

2. HOW TO EXAMINE ONE'S OWN TACIT KNOWLEDGE: TOWARDS A THEORY OF HEURISTIC REASONING

In the previous section I have argued that the terms "tacit knowing" and "tacit integration" fail to denote a homogeneous class of phenomena. The point is, namely, that some of the above discussed mechanisms operate on propositional subsidiaries, whereas others use such non-propositional subsidiaries as sensory signals, built-in processing rules, topographic cognitive schemas, classificatory cognitive schemas, and locating experiences. My contention is that this observation bears on the issue of heuristic reasoning, that is, of cognitive procedures whereby one can study and explicate the content of one's own tacit knowledge. In what follows, therefore, I offer a tentative typology of implicit mechanisms and consider its implications for the theory of heuristic theorizing.

Depending on the kind of the subsidiaries being operated on, one can distinguish between the following types of implicit mechanisms:

1. the mechanisms operating on representational subsidiaries:
1.1. the mechanisms operating on propositional representations: (c_1), (c_2),
1.2. the mechanisms operating on non-propositional representations:
1.2.1. the mechanisms operating on topographic cognitive schemas: (a_1), (a_2), (b_3),
1.2.2. the mechanisms operating on classificatory cognitive schemas:
second stage of (b_1), (b_3),
1.2.3. the mechanisms operating on locating experiences: (a_2),
2. the mechanisms operating on non-representational subsidiaries:
2.1. the mechanisms operating on functional subsidiaries: first stage of (b_1), (b_2),
2.2. the mechanisms operating on sensory subsidiaries: (a_1), (a_2), (b_1), (b_2), (b_3).

Note that some implicit mechanisms may fall under more than one of the types distinguished above. Therefore, the typology cannot be regarded as a classification. It is also worth stressing that almost all of the mechanism types listed above — with the exception of 1.2.3 and 2.2 — operate on subsidiaries that can be counted as coding or bearing general rather than particular knowledge about one's environment. With these observations in mind let us consider the issue of heuristic reasoning.

The idea of *heuristic theorizing* or *reasoning* comes from Ryszard Wójcicki, who in his "Is There Only One Truth?" observes that an organism's systematic experiential contact with its surrounding usually gives rise to the formation of subconscious ideas that are coded in its mind in the form of cognitive schemata or iconic representations. According to Ryszard Wójcicki, the ideas in question can be understood as the organism's tacit or implicit knowledge the content of which can be made explicit with the help of heuristic theorizing: a cognitive process that turns the organism's implicit knowledge into a full-fledged objective knowledge consisting of logically organised propositions.

Note that adopting the perspective presented in the current paper one can define heuristic reasoning as a cognitive procedure whose function is to examine and explicate the subsidiary items that play a role in one's practical, perceptual and cognitive activity. In my view, what motivates the agent or researcher to examine the content and structure of his subconscious ideas is the assumption that in some way they reflect the nature and structure of his empirical reality. Adopting an evolutionary perspective, namely, one can suppose that at least some of the items that an organism is subsidiarily aware of — for example, the topographic and classificatory cognitive schemas coded in its mind as well as the processing rules built into the functional architecture of its perceptual analysers — result from the organism's cognitive adaptation to its environment and as such can be regarded as making up its tacit or "personal" knowledge. One can also add that some of the organism's subconscious ideas have been acquired in the phylogenetic scale (by natural selection), whereas others have been formed in the ontogenetic scale (by learning). Be that as it may, they all can be counted as the organism's cognitive adaptation to the structure of its environment. The function of heuristic theorizing is to make them explicit and thereby to transform personal knowledge into objective knowledge.

Ryszard Wójcicki considers the following example of the procedure under discussion:

> To see clearly the difference between deriving conclusions from what has been already established and heuristic theorizing consider the origins of the Euclidean geometry. Already in the ancient times, the theory was a powerful tool for examining both dislocation and movements of objects on a surface (Greeks developed plain geometry). Note, however, that before geometry took the form of a full-fledged science, the practitioners were able to solve various both theoretic and practical matters with the help of their *intuitive knowledge*. No wonder then, that the Greeks who formed the science of geometry were concern with the *intuitive ideas* underlying the key concepts of the theory which they sought to form (a point meant to be a place of location of an object, a line meant to be the shortest path between two points, the distance meant to be the number of distance units one may locate one after the other on a given line, etc.). *Asking specific questions about such concepts, they looked for answers which all participants of the relevant discourse would accept as either directly evident or following in an unquestionable way from evident premises* (Wójcicki 2010, paragraph 4.13, emphasis mine — M.W.).

In short, one can reasonably assume that at least some of the Euclidean theorems correspond in structure and function to some of the subsidiary items whose job is to facilitate our performance of tasks requiring spatial abilities. It remains to be examined, however, whether our *intuitive* or *personal geometric knowledge* consists in our subsidiary awareness of representational or non-representational items. If the latter, then it takes the form of (*i*) processing rules making up the functional architecture of the early vision system, that is, of the system responsible for producing the primal sketches of distal layouts. If the former, then one can ask whether our intuitive geometry — that is, our tacit knowing or grasp of the laws of geometry — is to be described as (*ii*) a complex topographic schema coded in our minds or, rather, as (*iii*) a set of subconsciously accepted propositions.

Consider option (*iii*) first. If our intuitive geometry takes the form of subconsciously held beliefs, then the mechanism responsible for our spatial abilities and spatial imagination falls under type 1.1. Consistently, the kind of heuristic reasoning whereby an agent may study the content of his tacit geometric knowledge can be likened to recollecting or, more adequately, to brining into consciousness previously unconscious beliefs. Note also that option (*iii*) does not preclude the possibility of changing the agent's intuitive geometry — and, as a result, one's spatial abilities — by getting him to accept new axioms.

Next, consider option (*ii*). If our intuitive geometry takes the form of a complex topographic schema, then the relevant implicit mechanism falls under type 1.2.1. As a result, the heuristic reasoning whereby one can explicate the schema's structure cannot be regarded as a kind of recollecting. Rather, the agent can study his intuitive geometry by putting forth various hypotheses and asking himself whether or not they are obvious; in other words, the agent's implicit geometric knowledge manifests itself in his ability to make intuitive judgements about the truth and falsity of geometric theorems that are considered as reasonable hypotheses. Note that option (*ii*) precludes the possibility of changing one's intuitive geometry by getting one to believe different axioms. Nevertheless, it suggests that the agent's spatial abilities can be altered by systematically manipulating his spatial experience, that is, by keeping him in a non-Euclidean world for a sufficiently long period of time.

Finally, consider option (*i*). If our intuitive geometry takes the form of the system of processing rules underlying early vision, then the mechanism responsible for our spatial abilities falls under type 2.1. It is reasonable to assume that the conscious mind has no access to the structure and functional architecture of its early vision system. Therefore, to study one's intuitive geometric knowledge one has no alternative but to make intuitive evaluations of the hypotheses previously put forth. Note also that option (*i*) suggests that the agent's spatial abilities cannot be altered either in the short run or in the long run, that is, either by getting the agent to believe new axioms or by keeping him in a non-Euclidean environment. The point is, namely, that according to option (*i*) our intuitive geometry is neither tutored nor learned by experience; in other words, it has been acquired in the phylogenetic rather than ontogenetic scale.

My tentative hypothesis is that it is option (*i*) that offers an adequate account of our tacit geometric knowledge. I assume that our intuitive geometry involves neither propositional nor schematic subsidiaries; what it involves, rather, are functional subsidiaries conceived as built-in processing rules. In other words, my supposition is that the functional architecture of our early vision system is part of our species' cognitive adaptation to the geometric properties of our environment. Undoubtedly, more has to be done to justify my view. Let me only point out that the tentative hypothesis in question suffices to explain why most, if not all, reflexive agents are ready to accept the Euclidean theorems "as either directly evident or following in an unquestionable way from evident premises". Consider, by analogy, the hypothesis according to which our intuitive grammatical knowledge takes the form of processing rules built into the language perception system; note that it suffices to explain the competent speaker's ability to tell grammatical from ungrammatical utterances.

Let me end with the following two questions. (1) *How* is it possible for an organism to form, store, use, and re-use the subsidiary items making up its tacit knowledge? (2) *Whether* and, if yes, *how* is it possible for an agent to examine and explicate the subsidiary items making up his tacit knowledge? We expect an adequate and comprehensive theory of heuristic reasoning to answer these questions.

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