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Building an Antenna for Tacit Knowledge

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Résumé : Mon livre, *Tacit and Explicit Knowledge*, est introduit. L'introduction est également utile pour m'expliquer le livre à moi-même, l'auteur.

Abstract: My book, *Tacit and Explicit Knowledge*, is introduced. The introduction is also helpful in explaining the book to me, the author.

1 Introduction: The problem

I will try here to make the ideas in my book *Tacit and Explicit Knowledge* [Collins 2010], which I will refer to hereafter as “TEK”, more readily accessible.¹ I am not going to write a summary but to try to explain the book to myself while “speaking aloud” as it were. Sometimes arguments and ideas become clearer, even to their author, when they are explained for a second or third time and I believe I am still finding out things about the book, especially the first part.

I have spent a large part of my academic life investigating the area of physics known as gravitational wave detection. The founder of the field was an electrical engineer and introduced the term “antenna” to describe the detectors. Like radio aerials, the detectors were meant to capture the vestigial influence of some otherwise invisible field and make its properties palpable. In the early days these antennae were metal cylinders on rubber mounts surrounded by liquid gases in pipes. The modest physicist who built the most

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1. This introduction takes off from my “Three Kinds of Tacit Knowledge”, which was commissioned as an introduction to *Tacit and Explicit Knowledge* for a German audience. It was published as [Collins 2012]. In re-writing the piece for this volume I have made so many additions, changes and reorganisations that, though the overall framing of the piece remains the same, it merits a new title. To save confusion for readers who might encounter both versions, I have indicated many of the substantive changes with footnotes. I thank the editors of this volume for triggering the transformation of the piece.

reliable of these early machines often told me that the esoteric nature of gravitational waves did not concern him; he was “just a plumber”. I think that description fits me and TEK. TEK is an antenna built to capture and make palpable aspects of the mysterious tacit knowledge and I am just the plumber, albeit working with words and concepts, not metal and rubber. What we are both trying to do is make a machine that can enable us to catch a glimpse something ephemeral.²

TEK, I now realise, is based on a crude metaphor. Knowledge is a kind of “stuff” which you either have or do not have. If you have it you can do certain things, or understand certain things which you could not do or understand before; you are also enabled to make good judgments in respect of those things. For example, *before* you had some knowledge you could not build a working TEA-laser;³ once you have the knowledge you *can* build a working TEA-laser [Collins 1974]; [Collins 1985/1992]; *before* you had some knowledge you could not make good judgments about whether an interferometer would be able to detect gravitational waves with certain waveforms; once you have the knowledge you can make such judgements [Collins & Evans 2007]; [Giles 2006].

A critic might say that the idea that there is some “stuff” that is passed along is redundant—at one time you cannot build lasers and make judgements about interferometers and at another time you can and that is all there is to it; no “stuff” is involved—after all, you cannot see or smell the “stuff” so it is an “idle wheel”. The response is that physical metaphors are still as useful as they have been through the history of physics: you can’t see, or smell, gravity or magnetic lines of force (or even, as Hume pointed out, causes in general) but they are still useful hooks on which to hang your thinking.⁴ The “knowledge-stuff” metaphor is an especially useful hook in two ways: one can ask about the kinds of knowledge that exist and, noting that certain machines and devices and certain animals and plants can do the things that humans learn to do only by being infected by knowledge, one is forced to ask whether what the non-humans have is the same knowledge-stuff as the humans have or, if not, why not and what is the difference.

Secondly, knowledge-stuff is divided into two kinds: there is “explicit knowledge-stuff” and there is “tacit knowledge-stuff”. It is tempting to say that you *can* see and smell explicit knowledge. It is tempting to say that this published paper is explicit knowledge and you can see it, smell it, and carry it around. None of this is quite true because the books and papers are not themselves explicit knowledge. They are, rather, the means by which explicit knowledge is transmitted. They are like the germs which cause a disease rather than being the disease itself. But at least you can see and smell the germs

2. The antenna metaphor and this entire paragraph are new. I will probably include the antenna metaphor should there ever be a second edition of TEK.

3. TEA-laser stands for “Transversely Excited Atmospheric pressure carbon dioxide laser”. This was a kind of very powerful gas laser that was invented in the late 1960s and was very difficult to reproduce—at least at first.

4. None of this is spelled out in the book so I am already understanding it better.

when explicit knowledge is involved.⁵ But in the case of tacit knowledge you can't see the germs—not being able to capture the means of transmission of knowledge is what causes us to think of it as tacit knowledge. Where I argue in TEK that certain kinds of tacit knowledge can be made explicit, what I am doing is revealing how its transmission can be made visible and/or its implementation handled. Thus the most important difference between tacit and explicit knowledge is that explicit knowledge can be deliberately brought into existence at distant locations—the germs can be isolated and sent through the post or some such—while the germs of knowledge that is tacit cannot be sent around in this way because they cannot be seen or captured. Tacit knowledge is like a disease with invisible or as yet undiscovered germs; you cannot infect people through the post but it can be “caught” by those around you.

Thus we know of only one way to acquire tacit knowledge and that is to hang around with others who already have it.⁶ Explicating tacit knowledge is showing how it can be passed on in ways other than hanging about. The process which passes tacit knowledge around, so long as it has not been explicated—so long as the germs have not been made visible—is called “socialisation”. If I want to acquire the tacit knowledge pertaining to group “X” I need to spend time in their company interacting with them as much as possible; that way I increase my chances of catching their knowledge-disease. It is the way one learns to become fluent in a foreign language.

One can immediately see that the difference between tacit and explicit knowledge has enormous economic importance. Explicit knowledge is cheap to spread around—you can “broadcast” it and lots of people can buy it or get it for nothing. Tacit knowledge is much harder to distribute because to pass it on everyone has to be in the same location for a period. This means building schools and universities, laboratories, arranging for apprenticeships and so on—creating institutions in which people are brought together so they can catch knowledge-diseases off other people.⁷ Businesses, if they want to steal tacit knowledge from other businesses, have to capture some of the people from the other business so they can hang around and infect everyone; it is often

5. In the original I talked of the transmission of explicit knowledge rather than the transmission of the means to engender explicit knowledge. I apologise to readers of my work for sometimes referring loosely to speech, writing, and so forth, *as* explicit knowledge rather than as the means of transmitting explicit knowledge. I don't think any serious conceptual problems have resulted from this loose talk but corrections need to be made when exactness is an issue.

6. The steadily increasing “bandwidth” of the internet makes it tempting to think that one can “hang around” with people just by interacting with them electronically—hence the popularity of the idea of distance-learning and the like. But this is a mistake recognised by all those who are serious about communicating—we still have universities and schools and the airways are still clogged with businessmen and academics travelling to meet their colleagues.

7. Ordinary diseases spread through distributed societies pretty fast but the tacit knowledge disease is caught very slowly so the institutions that keep groups together for a long time are necessary.

cheaper and easier to buy the entire business along with the workers' tacit knowledge. Unsurprisingly, then, there is a lot of discussion about how and whether tacit knowledge can be converted into explicit knowledge. There are books in the management literature that claim to show how it is to be done.⁸ The question is also important to those who want to put human knowledge into machines—first it has to be captured in symbolic, that is explicit, form. As I will explain below, the answer to the question of whether tacit knowledge can be turned into explicit knowledge is that a little of it can, some of it can be converted in principle but not in practice, and a good bit of it cannot be converted in any way we can think of.

It was said above that if you have new knowledge you can do or understand new things. So suppose I enter the Amazon jungle, find an isolated tribe, and give them a copy of this paper. They won't be able to do or understand new things—at least, not by using the written content of the paper—they won't catch the disease. So it was an oversimplification to say that explicit knowledge can be "broadcast". Explicit knowledge can be broadcast but only if the circumstances are right—the receivers of the knowledge have to be receptive to the infection.⁹

The detail of how it is that sometimes the transmission of explicit knowledge works and sometimes it does not is complicated but something general can be said at the outset. Where humans are involved, the receivers of explicit knowledge have to be fluent in the language of the transmission medium and fluency in language is acquired as tacit knowledge. This is one reason why Polanyi was right when he said: "[...] all knowledge is either tacit or rooted in tacit knowledge. A wholly explicit knowledge is unthinkable" [Greene 1969, 144]. Explicit knowledge is a lot more complicated than it looks at first sight.

2 The explicit and explication

Thought about more deeply, it is the fact that there can be *explicit knowledge* that is really difficult to understand.¹⁰ Thought about more deeply, there is nothing hard to understand about tacit knowledge. Since the creation of the first life forms, things have been doing things without being able to make

8. Methods of converting tacit knowledge tend to deal with tiny areas of the problem with no grasp of how little it is that is being accomplished.

9. This context-boundedness creates a terrible mess exemplified by literature on semiotics which really struggles to work out what is a sign, what is an icon and so forth because the meanings of those terms are always shifting with context. I try to start from more basic elements, not signs or icons with their inherent implication of meaning, but with marks and patterns that might or might not be meaningful.

10. A vast amount has been written about how messages become "distorted", how "the author is dead" and how meanings are "socially constructed" but here we are dealing with a different subject—the fact that sometimes a message does empower its receiver in roughly the ways one might expect.

explicit how it is they do them. Thus trees grow leaves and cats hunt mice without being able to explain how they do it and without being able to pass on those abilities in symbolic form. Likewise, we do not think it mysterious that we humans can pump blood round our bodies without being told how to do it nor learn to walk and speak without following a rule-book. What is exceptional is that sometime humans acquired the ability to talk about some of the things they could do and pass on these abilities by transferring materials with patterns on them. In the book I call such materials “strings”.

By the middle of the Twentieth Century, probably because of the optimism associated with the early computers, people thought it so normal to be able to represent and transmit abilities via strings that they had to invent a special term associated with abilities that could *not* be so transmitted. This term was “tacit knowledge”. Because all human abilities were talked of as manifestations of knowledge it was taken that those abilities that could not be passed around in the form of strings were manifestations of tacit knowledge. Remarkably, tacit knowledge—not being able to represent what you could do with strings—came to seem to be something extraordinary and mysterious rather than the perfectly ordinary state of affairs.

But it is explicit knowledge that is the astonishing thing. Material things, such as vibrations in the air or marks on paper, pass around and, as a result, people can do or understand new things; there seems to be no causal relationship between the material scraps that are passed around and the abilities and understanding that they induce. There was never anything like this in the universe before the invention of language—the real “big bang”. The opening of Stanley Kubrik’s film, *2001: A Space Odyssey*, shows early humans transformed into tool-users by coming into contact with a mysterious black obelisk. The development of the ability to use scraps of material to transmit knowledge and understanding should be thought about in grand terms like this; there must have been some equivalent of the black obelisk that made it possible for those strange scraps of material that I call strings to have such remarkable effects.¹¹

Chapters 1-3 of my book and some of the Introduction are about explicit knowledge—how people pass on knowledge by passing around materials carrying patterns—strings. The term “string” has been used in other discourses, such as that of computer programming and, of course, physicists’ “string theory”.¹² To save confusion I would probably have been better off inventing a new word such as “grom”. A string, as it is used here, is about as meaningless as a “grom”. A string is simply any material thing made of anything that is not completely plain or random. Vibrations in the air are strings, patterns of dirt on rocks are strings, and printed words are strings. The very non-specificity of the notion of string is important as it helps with understanding

11. This paragraph is entirely new to this publication—I will include the sentiment should there ever be a new edition of TEK.

12. This passage is new to this version of the paper.

how strange the transmission of explicit knowledge is. It can be done with any material thing provided the conditions are right. The notion of “symbol” is far too confusing—a symbol is a string in the right circumstances. To ask the deep question about what are the circumstances that enable some scrap of material to act as a symbol you have to start with these essentially meaningless strings and struggle to work out how it is that sometimes they appear to convey meaning.

String transformations are fundamental to understanding how the world works. All languages, including purely spoken languages, have to be represented in some approximate way by strings. But languages are not strings. Strings are meaningless—just bits of stuff—whereas languages are meaningful. Using languages involves lots of string transformations so string transformation can easily be confused with language. In spoken language, for example, a set of mouth, throat and chest movements is transformed into a set of vibrations in the air, which are transformed into movements of the ear, which are transformed into a set of electric currents and so on. Usually the elements of the transformation process are transient; Edison invented a way to transform some usually temporary strings into more permanent strings.¹³

Strings carry “information” not meaning. The information that they carry has to do with the number and arrangement of their components. This is what “information theory” is all about. “Information theory” can tell you how to remedy losses in information transmission or at least how to measure them. It is because strings are without meaning that “information theory” is a success; there can be no comparable “meaning theory”. There can be no equally successful meaning theory because while information is a property of strings, meanings are a property of the societies in which languages live and continually evolve.

In spite of having written three chapters in TEK about the relationship between language and strings and the way knowledge is passed on using strings I do not understand how it works. All I manage to explain in TEK is some of the differences between occasions when knowledge transmission using strings does work and occasions when it does not work—I describe some of the “solutions” that can turn a failed attempt to transmit knowledge using strings into a successful attempt to transmit knowledge using strings. This does not solve the deep problem of explicit knowledge—I still do not understand the mechanism of those successes—I can only explain why the successes work better than the failures. But this does allow one to describe the process of explication even if it does not explain how there can be “an explicit” in the first place.

Tacit knowledge is knowledge that cannot be explicated or is not explicated—it is not or cannot be passed on using strings. Some of it may be passable by using strings in the future and some of it may be passable using strings in other places. A lot of what is thought to be irredeemably tacit can be explicated once we work out how and in other places it may

13. Are the indentations on a gramophone record symbols? They are strings.

not seem so irredeemable. If it is the case that tacit knowledge is knowledge that cannot be explicated then there are as many kinds of tacit knowledge as there are reasons that stop it becoming explicated. There are three kinds of reasons why tacit knowledge cannot be explicated so there are three kinds of tacit knowledge.

We still have to know a bit more about what “explicated” means. I argue in Chapters 1-3 of TEK that explicated can mean four things. One can be illustrated very simply. Somewhere in the text that you have read is a full-stop and printed within that full-stop in microscopic lettering is a message that is important to you and will empower you in certain ways. The full stop is what spies call a “microdot”. You did “see” that full-stop but it had no impact on you. Now, so long as the context is right, we can render the message in that full-stop explicit by physically transforming it. If we simply transform the full-stop and its message into something much larger, what was not explicit will become explicit and may now have the desired empowering effect upon you. If you knew where the full stop was and you had a powerful magnifying glass you could transform the string into something that could convey meaning to a fluent English speaker. You would see: “Drinking coffee makes your hair fall out”. This is an example of explication by physical transformation of a string.

That simple example explains a lot. When I push a CD into my computer’s drive and some words, or pictures, come up on the screen, physical transformation is what is going on. We say the computer is “reading” the disk but actually it is taking the marks on the CD, which you can’t read, and transforming them into marks you can read—just like looking at the full-stop through a magnifying glass; the computer is a kind of complicated magnifying glass. Both computers and magnifying glasses do physical transformations on strings. String transformation is the only thing that computers and magnifying glasses do.

Another kind of “explicating” is exemplified in TEK with an old joke about people who regularly go to a certain pub (sometimes it is the long-term inmates of a prison), who tell each other jokes by just shouting out numbers. Each number refers to a joke that everyone in the pub (or prison) already knows. For the rest of us the same joke has to be explained at full length if we are to understand it. The pub or prison situation is sometimes reproduced in ordinary life when long-standing members of bureaucratic organisation talk almost entirely in acronyms which outsiders cannot understand [TEK, 22–23]. The point is that sometimes a short string will have no knowledge-inducing effect but a longer string can induce the knowledge. Lengthening a string is the second kind of explication.

There are two other ways in which strings are transformed to the point they can be interpreted and which seem to fit into the way we use our language as examples of things being made explicit. The first of these is when we transform some causal/behavioural sequence that we can accomplish without knowing how, into the form of some artefact we have created, such as a

machine. A machine is a permanent string that produces temporary strings. (One should begin to see that the definition of string is so broad that it encompasses causal sequences and artefacts as well as patterns—the point is that causal sequences and artefacts are patterns.) Thus, when we make a machine that roughly reproduces some activity of ours that we are trying to understand (like balancing on a bike or playing chess), we can say that the working of the activity has been made explicit. For example, many people now think they understand chess because grand-master chess-playing machines have been built. Others say that these machines do not play chess like humans so human chess-playing has not been understood. We do not need to settle this argument to see that if the machines *had* reproduced human-like chess we would no longer say that chess always depends on tacit knowledge. Therefore humans' ability to play chess must have been explicated. The point is that the workings of the machine and the behaviour of the machine can be readily interpreted: the machine is a string that can be easily interpreted by (certain) humans (that is, in this case, those who live in Western societies rather than the Amazon jungle)—it is, therefore, properly referred to as explicated knowledge.

The final way of talking about explication is closely related: it is when some sequence has been represented in the language of science—some set of equations or words—a string—which can be interpreted as explaining how something works. These four meanings of explicable are set out in Table 1, which is a reproduction of Table 4 on page 81 of TEK.

1. Explicable by elaboration	A longer string affords meaning when a short one does not
2. Explicable by transformation	Physical transformation of strings enhances their causal effect and affordance
3. Explicable as mechanisation	A string is transformed into mechanical causes and effects that mimic human action
4. Explicable as explanation	Mechanical causes and effects are transformed into strings called scientific explanations

Table 1: Four meanings of explicable

3 The tacit

So now I think I begin to see even better what is in my book. I make no attempt in TEK to explain why it is possible that certain things can be interpreted meaningfully by humans. It is just assumed that there are some things that mean something in one place and another thing in other places and sometimes things that are meaningful in one place have no meaning in others; the only question is why those meaningful things sometimes can, and sometimes cannot, be transmitted via strings.

Having set the problem up in this way we can get to the heart of the matter. The heart of the matter is found in Chapters 4, 5 and 6 of TEK. Ironically, the difficult part of the book is finding a way to understand the question and setting it up so that it is possible to answer it. That was the process of designing the tacit-knowledge antenna. Answering the question—using the antenna—is a comparatively straightforward business. There are three kinds of reason why meaningful knowledge is not, or cannot be, transmitted by strings and this means there are three kinds of tacit knowledge. It remains only to set out the three kinds of tacit knowledge: they are Relational Tacit Knowledge, for which I will use the acronym, RTK, Somatic Tacit Knowledge (STK) and Collective Tacit Knowledge (CTK). These three kinds can also be thought of as “weak”, “medium” and “strong” tacit knowledge.

3.1 Relational Tacit Knowledge (RTK)

Relational Tacit Knowledge is a ragbag category but the simplest of all once one has the idea. In RTK knowledge is tacit, for the time being, because social ‘r’elations are what they are. Change the social relations between people and what was once tacit can become explicit.

“Secrets” are an everyday example of RTK. Because their social relations can be competitive, scientists sometimes do not transmit strings to others even though they know they will be meaningful and empowering. A more subtle element of RTK is “mismatched salience”. In that case the “transmitter” has an incorrect model of the “receiver’s” knowledge and does not realise that some piece of information that seems perfectly obvious to the one party is not obvious to the other so it does not occur even to try and transmit it as a string; likewise, the receiver does not know what to ask. Closer social relations can resolve the problem.

Thirdly, there is knowledge that one party is unaware of possessing. The classic case concerns the position of the capacitor in the early days of the construction of the TEA-laser, see note 3 [Collins 1985/1992]. Here successful laser builders placed their heavy capacitors in the awkward “traditional” position—elevated and inverted—whereas those working from circuit diagrams would more likely place them on the bench, in which case the laser would not work. It was only later that the successful laser builders realised that the awkward positioning was essential because it shortened the top lead and lowered its inductance. So, in the early days the successful laser-builders could not have constructed the relevant empowering string however much they wanted to; later they could. Here the idea that the knowledge is tacit in consequence of social relations is strained but we can still find an excuse to use the ‘R’ in RTK by saying that new ideas are in-part expressed by changing social relations among scientists.¹⁴

14. “The social relations between men and the ideas which men’s action embody are really the same thing considered from different points of view [...]” [Winch 1958, 121].

RTK includes things like secrets which it seems gratuitous to refer to as anything as mysterious as tacit knowledge. A secret is something that is perfectly explicable but someone chooses not to explicate to someone else—why mystify it? RTK also includes things that are tacit for now but can become explicit in time—for example as scientific knowledge increases. But the category just about holds together as a species of tacit knowledge because in every case the knowledge, whether it secret or just currently not understood, can be passed on by “hanging around”—for example, hanging around successful laser builders. Secrets can be revealed by just watching what is going on—by spying; mismatched saliences will become matched, and traditional methods of doing things will be passed on just by hanging around without anyone realising their significance or even that it is happening. Hence RTK possesses the crucial characteristic that it cannot be passed on by strings—at least, not until or unless it becomes explicated—but it can be passed on through social contact. This is what ties it to the other categories of tacit knowledge though sometimes it seems a bit of a strain.

Note, that in principle there is nothing to stop every piece of RTK from becoming explicit: secrets could be told; if one had a better model of the recipients’ knowledge one could pass on bits of knowledge in the form of strings that one had not initially realised needed to be passed on; and as more science is done (category 4 of explicability) the importance of things like the inductance of the top lead become clear enough to be expressed in strings. Of course, this does not mean that all the elements of RTK can be told here and now or even that all the elements can ever be explicated; what it means is that any one element can be explicated given the will, the understanding and the effort. That said, there will always be RTK because there will always be secrets; we will never have complete knowledge of the contents of others’ heads; and science will never be finished. The continued existence of RTK is more a matter of social relations and of logistics than of epistemology but, like death and taxes, social relations and logistics are always with us.

3.2 Somatic Tacit Knowledge (STK)

Somatic Tacit Knowledge is tacit because it is stored in the arrangements of the body. The classic case of STK is the ability to ride a bicycle—the case discussed by Polanyi. As Polanyi famously said:

If I know how to ride a bicycle [...], this does not mean that I can tell how I manage to keep my balance on a bicycle [...] I may not have the slightest idea of how I do this, or even an entirely wrong or grossly imperfect idea of it, and yet go on cycling [...] merrily. Nor can it be said that I know how to bicycle [...] and yet do *not* know how to co-ordinate the complex pattern of muscular acts by which I do my cycling [...] I both know how to carry out (this performance) as a whole and also know how to carry out the

elementary acts which constitute (it), although I cannot tell what these acts are. [Polanyi 1966, 4]

This is an iconic description of the meaning of tacit knowledge and it fits well with much of the philosophy that has to do with the body. For example, Dreyfus and Dreyfus's "five stage" model of skill acquisition is to do with the "internalisation" of skills such as car-driving: it is only novices who rely on trying to follow explicit rules whereas true skills involve unconscious processes of far greater complexity which cannot be captured by any set of rules [Dreyfus & Dreyfus 1986]. True skills of this sort are embodied and not transformable into strings. This view also fits well with that of philosophers such as Heidegger and Merleau-Ponty.

And yet there is something badly wrong with Polanyi's understanding of bicycle-riding. One can begin to see why by looking only a couple of pages further on in the source from which the above quotation is taken. Polanyi also says:

[I]n order to compensate for a given angle of imbalance α we must take a curve on the side of the imbalance, of which the radius (r) should be proportionate to the square of the velocity (v) over the imbalance $r \sim v^2/\alpha$. [Polanyi 1966, 6–7]

In other words, Polanyi says there *is* a set of rules for bicycle riding—it is just that we humans cannot follow them. To see what is being claimed here, imagine the following: we are trying to ride a bicycle on the surface of a small asteroid so that the pull of gravity is only a millionth of what it is on Earth and the bike, when it becomes unbalanced, falls so slowly it is, as the English expression goes, like watching paint dry. In such a case there would be no reason why we might not carry a booklet with Polanyi's instructions for bike-riding and a few geometrical instruments and keep the bike balanced in rather the same way as we currently assemble flat-pack furniture—by reference forward and back to the instruction book while using a few tools. Now put the bike back on Earth and imagine that our brains and bodies worked a million times faster—then balancing on the bike would still be like balancing on the asteroid; it would be possible to manage via explicit knowledge—interpreted strings. So while Polanyi may be perfectly right about how we humans actually balance on bikes, and it involves "somatic tacit knowledge", it does not follow that it is impossible to make this knowledge explicit and usable by different kinds of creatures with faster processing and reaction times—and it should come as no surprise that there are machines that can balance on bicycles. So Polanyi himself has made the knowledge of bike-balancing explicable in the sense of Table 1 category 4 and clever engineers have made it explicable in the sense of category 3.

"Somatic limit tacit knowledge" is knowledge that remains tacit in use solely because of the limited capabilities of human brains and bodies. I argue in the book that all somatic tacit knowledge—which is the staple of the phenomenological literature that is concerned with the body—is like this. It is

much less mysterious than it has been made out to be and each bit of it could, in principle, be rendered explicit in the way just demonstrated in respect of the bicycle. The same goes for the abilities of cats, dogs, trees and sieves though, as I show, the case of something as simple as a sieve sorting stones, it can be extremely complicated actually to make some physical process explicit. Here, however, the limit to the explicability of the knowledge is, again, not epistemological, but a matter of the limits of our scientific abilities. Though we would struggle to reproduce the sorting method of a sieve—which depends, for example, on the exact shape of the stones, many coefficients of friction and just how the sieve is shaken—a much more accomplished scientific race, for whom the sieve problem would be trivial, might have explicated much of even the STK of our bodies and brains. We humans, of course have to continue to use this knowledge as tacit knowledge—something stored in the materials of our bodies (and how we do this remains an interesting topic for analysis), but, again, this is just a matter of how we happen to be constituted.

TEK also argues that certain elements of STK may never be explicable in terms of category 3—that is, we may never be able to reproduce what we do mechanically—because of the very properties of the physical materials of which we are made. That is to reproduce us mechanically, the materials and mechanism would have to be identical—so it would be like making a three-dimensional photo-copy of us rather than reproducing in another form. That is not explicating, only copying (though one might need to explicate in order to understand what it would be to make an *identical* copy since there are an indefinite number of dimensions of possible difference). When it is the case that reproduction of the materials of the human body are essential to the reproduction of the actions they can carry out I call it “somatic affordance tacit knowledge”—it is the materials of body itself, or of the brain, which is part of the body, that affords the possibility of the action in question.

3.3 Collective Tacit Knowledge (CTK)

Collective Tacit Knowledge is the most profound case. To see what it is we can begin, once more, with Polanyi and the bicycle. What has been dealt with in the last section is what can be called “bicycle-balancing”. It is all about how one keeps the bike upright on the asteroid, on Earth, or whatever. But there is an entirely different aspect of bicycle-balancing which Polanyi does not deal with and for which there truly is no formula. This is bike-riding in traffic. Dreyfus and Dreyfus do discuss car-driving in traffic but they do not seem to notice the difference between this and controlling the car—the gears, the steering, and so forth; for Dreyfus and Dreyfus there is no discontinuity between the STK of the gear-shift and the very different kind of tacit knowledge needed to drive “in social concert”.

To start to see the difference one can note that balancing on a bike, or mechanically controlling a car, is the same process wherever it is executed

whereas riding/driving in traffic is hugely different in different places and in different circumstances. Riding my bike in Cardiff I know I can ride on the pavement (sidewalk) without anyone bothering me—pedestrians will get out of my way with a smile so long as I am polite. I noticed the same thing in Tokyo recently. But there are other towns even the UK where it would be unthinkable to ride your bike on the pavement. I know that in the UK I can cross a road on my bike against a red light so long as I can “catch the eye” of the drivers who are waiting to go as soon as the green light comes on in their favour and they indicate their agreement with the tiniest acknowledgement. But I also know that if I ride in the UK at night I would be well-advised to have lights and that if I am driving my car I am entitled to be furious at any bike-rider who does not have lights. In contrast, in Beijing bike riders ride everywhere at night without lights and no-one gets furious. I notice that car-drivers in China do things, like cutting corners, and driving on the wrong side of the road, that would be unimaginable in Europe or America. But I notice that you can do many more outrageous things in Italy when you drive a car than you can in the UK and no-one gets angry [Collins 2004, 398–399].

So what I am doing here, *so it seems*, is providing strings that will enable you to understand how to ride your bike or your car in different countries. But this is misleading. First, my description of Chinese driving was of a few years back—perhaps it has all changed. And which are those towns where you can and can’t ride on the pavement? The recipe—the set of strings—is never fixed and never predictable because it is the property of entire societies and the way societies change is unpredictable. To know what the rule is I have to go to the society and find out by being there—there is no rule about how frequently and how fast the rules change. What can be done is to say “in that frozen moment of past time, 2005, these were some rules for riding bikes in those parts of Beijing that I visited”, but that does not tell you how to ride on your next visit.

Much more important, I have provided no string for telling you how to “catch the eye” of a car driver nor how to recognise whether the look they return is an acknowledgement of the fact that they are not going to run me over when I cross in front of them or not. And I cannot provide such strings. Such things are only acquired through immersion in the society.

Riding-in-traffic has the same structure as language fluency. Fluency in languages cannot be acquired from the most exhaustive study of dictionaries, grammar books and guides to foreigners’ habits, it can only be acquired by spending time in the language-speaking community. The way to think about this kind of knowledge is as belonging to the collectivity, not the individual. That is why it is called “Collective Tacit Knowledge”. Language is not under anyone’s control—what happens in the whole community is what determines what can be said and what cannot be said at this time and place while even the rules for a complete description of a frozen moment are indefinitely long. All this is true of every kind of collective tacit knowledge.

What we as individuals do is *borrow* the knowledge of collectivities for a short time. We borrow it in the typical way of catching tacit knowledge—which is the typical way of catching diseases: we hang around with people who already have the knowledge/disease. But if we stay away from the communal “host” on which we are a “parasite” our disease will begin to mutate. Our language will degrade and depart from the host language—it will become archaic, or come to resemble a cargo-cult language that no longer reflects the meanings of the same terms in the host. It is the same with all CTK. It is only CTK which we can think of no way to explicate it in any of the four senses of explicate—not even in principle. All we parasites can do, to change the metaphor, is suck continually on our collective host’s CTK-blood.

4 Conclusion

The term tacit knowledge, as it is used in academia, applies to three very different things that are usually not distinguished. This is not surprising because in most cases of the acquisition of tacit knowledge, all three kinds are being acquired at the same time in a very confounded way. Because of this, all manner of false claims have been made about the way the tacit *can* be turned into the explicit or the tacit *cannot* be turned into the explicit. Only by keeping the three types of tacit knowledge separate will we understand what is really going on when knowledge is transferred.

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