The Universe, Life and Everything

Dialogues on our Changing Understanding of Reality

Sarah Durston and Ton Baggerman

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1 What is reality?

The book you are holding is about the way we view the world.[1] It is about the way we understand reality: the world we live in, our place in it and the universe around us.[2] The way we view our world is changing. There is a perceivable shift in the way people (both scientists and non-scientists) think about it. Furthermore, this is a necessary and timely shift. Our modern understanding of reality dates back to the work of Descartes, Newton and their contemporaries, some 350 years ago. It is the backbone of modern-day, Western society and it has been a manifestly successful way to understand the world around us, bringing us science, industry and the Enlightenment, leading to spectacular increases in wealth worldwide, allowing culture and society to flourish. However, there are areas where our current scientific world view falters. There are phenomena that it cannot explain, as we will see further on. The premise of this book is that there is a shift occurring in the way we understand reality, precisely because our current world view is reaching its limits. People are beginning to understand the world and themselves as interconnected, rather than as individual entities bound together only by cause and effect. The goal of this book is to sketch a picture of what this new, connected world view might look like. First though, let us explain what the authors, Sarah & Ton, mean by 'our current world view'.

1 The title refers to the third book in Douglas Adams' 'The Hitchhiker's Guide to the Galaxy' series. In the series, he finds that the answer to 'life, the universe and everything' is 42 (even if nobody remembers the original question).

2 In this text, the word 'we' is intended to refer to people in general. Although it could reasonably be argued that it more accurately refers to the subset of people that is the audience the authors (Sarah & Ton) expect this book to be most of interest to (people with a Western background and interest in science). The authors have referred to themselves in the third person to avoid confusion.

What is our current understanding of reality?

Our current scientific understanding of the world builds on the work of Descartes, Newton and their contemporaries in the 1650s, who in turn built on their predecessors. Descartes suggested that mind and matter should be considered separately so that the mathematical laws that govern the behaviour of the matter could be studied. Newton then began to uncover the workings of these laws, famously being inspired to describe gravity when an apple fell from a tree and hit him on the head. From these beginnings, our modern-day natural sciences, including physics, chemistry and biology were developed. They are at the basis of our currently accepted scientific paradigm[3] that states that reality is built out of matter and energy that can cause matter to move, change form and interact with other matter. The assumptions we make about our world every day are built on this central premise. Some of those are:

Atomism/materialism: the idea that the world with everything in it and the stellar realm around it consists of mindless, separable pieces of matter. The question 'what is matter made of?' is answered with 'smaller bits of matter' all the way down to the subatomic level. In principle, there are no limits to the scale of this analysis and this assumption is usually presumed to hold at both the extremely large scale, including stars, galaxies and the universe, and the extremely small scale, including atoms and electrons.

Determinism: the idea that there is a basic set of (physical) laws that predict the behaviour of physical objects, such as their location and speed. Gravity is an example of such a law, where the force with which two objects attract each other is determined

3 The word 'paradigm' refers to a distinct set of theories, concepts and thought patterns that (implicitly) underlie our (scientific) understanding of the world. This manuscript follows Thomas Kuhn's suggestion that science does not progress linearly but rather through 'paradigm shifts' that open up new approaches that would previously not have been considered scientifically valid. The authors suggest that is what is currently happening.

by their mass and the distance between them. Another such law is the law of cause and effect, where the events we observe in the world around us do not come randomly out of nothing. They are preceded in time by the other events that cause them. An extreme position in determinism is the conclusion that free will does not exist. After all, if cause and effect underlie reality, how could something as intangible as wanting something affect it?

The absolute nature of space and time: the idea that space and time are objectively measurable and independent phenomena, and that they merely form the stage for material processes. Furthermore, this stage is callously immune to the events taking place on it. Of all the materialistic assumptions, this may be the most intuitive one: after all, we all have experienced time ticking away at a frustratingly slow pace, with no apparent way to affect it.

Overall, the classical scientific paradigm views nature as a machine with interacting parts, like something of a giant clockwork apparatus. If we analyse the apparatus by investigating its parts and their cause-effect relationships, we can understand and manipulate it. While we have expanded this metaphor to include more modern versions (such as comparing our brain to a computer in neuroscience), this has been at the basis of our world view for the past few centuries. It has become so engrained in how we understand reality that we literally experience the world that way: we perceive a distinct self; an 'I' that observes and interacts with a world around us that is full of physical objects. This is so obvious to us that it is hard to imagine that this is not how people have always experienced the world. However, to many people in the period before Descartes and Newton, the world was a magical and potentially fearful place, where deities could affect (and therefore ruin) lives by sending disasters as punishment, and who might send omens as warnings. It was therefore necessary to interpret the signals sent to you by nature. The world was not a physical apparatus, it was a place run by an external force. It may seem ridiculous to us now, but for people at the time this was as true as our world view is to us today. Just as they did, we

have forgotten that our world view is a working model that we have constructed: it is a paradigm, not the absolute truth. People at different times (and in different cultures) experience reality in different ways. The authors of this book, Sarah & Ton, wrote it because they believe the way we experience reality is changing; that it is a good and a timely change; and because they wanted to investigate what shape our new understanding of reality is taking. So far, it has been a wonderful journey, one they hope will long continue. It has felt like being Alice wandering through Wonderland, every new finding 'Curiouser and curiouser' than the last.[4]

What has been the approach?

The method Sarah & Ton chose to investigate what a new understanding of reality might look like was to seek out visionaries from widely varying backgrounds, and ask them how they view the new paradigm that we are moving towards. Admittedly, this was a risky approach, as the answers may easily have varied equally widely and not have painted a coherent picture. However, that is not what happened. What Sarah & Ton found was a remarkable agreement between their ideas and those of the people they spoke to, an encouraging sign that there is indeed a paradigm shift underway. Now, before letting the contributors tell you about their ideas themselves, let's introduce the cast beginning with the authors.

Sarah & Ton first met over sushi, a very good way to meet someone. It turned out that they were on similar quests but from different perspectives. *Sarah* is a professor in neuroscience. Her work focuses on the brain in developmental disorders, such as ADHD and autism, and her scientific focus had always been

4 From Lewis Carroll's novel *Alice's adventures in Wonderland* (1865). Interestingly, Carroll also makes multiple references to the number 42 in his works (see note 1).

how brain function can lead to symptoms. For the last couple of years, however, she has been realising that we do not seem to be getting any closer to finding answers and started to wonder why not. This question brought her to the science of consciousness: symptoms in developmental disorders, and psychiatry more generally, are part of human experience. For the person with a diagnosis, symptoms are part of who he or she is. Clearly therefore, we need to address how brain function relates to the experience of being a person, if we are to understand psychiatry.

Ton is a psychotherapist. In his work, he became increasingly worried by the current professional standard of classifying clients and their problems into categories of 'disorders'. Talking to clients invariably reveals strengths, desires and aspirations, in addition to problems. In an attempt to reconcile these two aspects of psychotherapy, he began to ask what the common ground is between these two different approaches. It struck him that we are all trying to give meaning to our lives by combining existing possibilities into new ones. This may sometimes be frustrating and is not always successful, but together these individual processes go into the wonderful jigsaw that is human life.

Herman Wijffels & Herma van der Weide: the first dialogue took place in October 2015, when Sarah & Ton spoke to Herman Wijffels and Herma van der Weide, husband and wife. *Herman* is a Dutch economist. He was the director of one of the largest national Dutch banks, the Rabobank, for more than 25 years, the chair of the Socio-Economic Council (SER)[5] and then the Dutch representative at the World Bank in Washington. He has been politically active and in 2006 succeeded in leading the negotiations to form a new coalition government in the Netherlands after others had failed. He has been called the 'best prime minister the Netherlands never had'.[6] After he retired from political life and

5 The Socio-economic Council is an important advisory committee to the Dutch government.

6 By Wouter Bos, deputy prime minister of the Netherlands at the time, in a national Dutch newspaper (*de Volkskrant*), June 16th 2009.

the financial sector, he was appointed Professor of Sustainability at Utrecht University in the Netherlands. There, he founded the Sustainable Finance Lab. He is on a mission to inform and inspire people about a more durable way of life, taking the sustainability of our planet into account. He argues that we need to move away from our 'linear' economy, where goods are consumed and then thrown out to a 'circular' one, where waste products form the raw materials for new products.

Herma was originally trained in Dutch literature and language and taught that topic at a high school for many years. She learned transcendental meditation from a colleague, and she and Herman meditate together daily (Herman practises Zen meditation). She went on to train as a Jungian psychotherapist and now has a Jungian practice in the Netherlands. She has been surprised by how many academically trained clients come to her to engage their more spiritual side. She also still teaches literature, as investigating Jungian archetypes is very much connected to literature for her. She and Herman run leadership programmes together.

Henry Stapp: in December 2015, Sarah & Ton spoke to Henry Stapp. Henry is a (retired) Professor of Quantum Physics at the University of California's famed Lawrence Berkeley National Laboratory. He has written books on the relationship between physics (quantum mechanics in particular) and consciousness, with titles such as 'Mind, Matter and Quantum Mechanics' and 'Mindful Universe: Quantum Mechanics and the Participating Observer'. He draws from the work of founders of quantum mechanics such as Wolfgang Pauli and Werner Heisenberg (both of whom he worked with personally) and John Von Neumann. As early on as the 1920s, quantum physicists had concluded that the evolution of the physically described universe was not governed exclusively by mechanical laws, but is controlled in part by our human value-based intentions. The central purpose of much of Henry's recent work has been to explain how our conscious minds can influence the evolution of the physical universe.

Alexander Wendt: in August 2016, Sarah & Ton spoke to Alexander Wendt. Alex is Professor of International Relations in the Political Science Department at The Ohio State University. In the late 1990s, Alex challenged realism, the dominant framework in his field. He disagreed with a basic assumption (that he later recognised stems from our classical paradigm) and proposed a more interactive framework, known as constructivism. In realism, states are regarded as billiard balls, interacting with each other in a mechanistic manner and driven mainly by the pursuit of self-interest. In such a world, conflict is the rule and cooperation an exception. Alex pointed out that states, as well as the people within them, are driven by many different motives. Instead of behaving mechanistically, states attribute meaning in interpreting each other's actions and deciding how to react. One example is that most Western countries consider the few nuclear weapons in North Korea to be a far greater threat than the hundreds in the UK. They are more threatening because of the intentions of (or attributed to) the nation that owns them. Alex then turned to the broader issue of the shifting paradigm in science as a whole. In 2015, after ten years of studying classical physics, quantum mechanics, philosophy of mind and many other domains, he published his book 'Quantum Mind and Social Science'. In it, Alex takes on the many counterintuitive notions of modern-day physics and applies them to the realm of human behaviour.

Erik Verlinde: Sarah & Ton spoke to Erik Verlinde in early 2017. Erik is Professor of Theoretical Physics at the University of Amsterdam. He is well known for his theory of gravity as an emergent feature of the underlying structure of reality, information at the quantum level. He has made the comparison to air pressure, where the atoms in air do not have pressure; rather it is an emergent feature of their motion and number. He suggests that gravity is a similarly emergent feature of underlying (usually invisible) information, where objects that are closer to each other tend to move toward each other, similar to ships that are berthed close to one another. With ships, this happens

because the waves around them push them closer together, while the waves between the ships are smaller and can thus not prevent this happening. He has used this theory to argue against the big bang theory as an explanation for the universe, showing that assuming the existence of dark matter is an unnecessary correction factor in his theory. He published the most recent detailing of his theory as a paper on the physics website arxiv.org entitled 'Emergent Gravity and the Dark Universe'.

As you can tell, these dialogues are something of a 'work in progress' and the authors hope to speak to many more of their peers who are advancing a renewed understanding of our world. This book was put together to share some of these ideas with a wider audience early on in the process, hoping perhaps to contribute to it.

2 Why do we need to expand our understanding of reality?

Why would we need a new world view? The only possible reason is if the old one is failing, and let's be realistic: our classic, Newtonian, deterministic view of reality has been hugely successful. It has brought us modern science. It brought us the industrial revolution. It has revolutionised technology, medicine, agriculture, all aspects of our world. Why would we critique it? First of all, our thinking is so rooted in this paradigm that we have forgotten that it *is* a paradigm, a way of viewing the world, and not fact. As such, there may be other, perhaps complementary, ways to view the world that are equally useful and that may extend our understanding beyond what we can achieve using our conventional view. Second, there are areas in which our paradigm is beginning to falter, aspects of our reality that it does not fit. Yet, we are very attached to our world view, so we do not always want to recognise that it may be flagging. This chapter outlines three areas where our paradigm is reaching its limits to explain why we need to expand it. Furthermore, it gives some examples of how attached people are to thinking in terms of the classical paradigm.

Consciousness

One of the most obvious problems with our current paradigm is that it cannot account for consciousness. Matter, including, biological, living matter, is built up of molecules and atoms, where the latter are the building blocks for the former. Yet these building blocks are inanimate and there is no reason in science that certain configurations of them would acquire awareness, consciousness, or indeed be alive.

It is hard to give a comprehensive definition of consciousness, as it is a complex phenomenon. However, as different scientists

and different disciplines use the term in different ways, it is necessary to say something about it. In this book, the term refers to having a 'sense of self', in the sense of feeling like an individual. In daily practice, the term is also often used as a synonym for 'awareness', in the sense that we can be conscious *of* something. To illustrate the difference: a mosquito may well be aware of a hand moving rapidly in its direction, yet it is hard to imagine a mosquito reflecting on its 'mosquito-ness', in the way that we can reflect upon ourselves. This book uses the term consciousness in the second sense. When it means to refer to the first sense, the term awareness is used. In the dialogues, the authors have noted which word was used.[7]

The classical contemporary view is that awareness and consciousness emerge from brain function. Yet the mechanism for this emergence is not understood and efforts to localise consciousness in the brain to date have been unsuccessful.[8] It is of course possible that our techniques are simply not advanced enough and that at some point in the next ten to twenty years it will simply show up. But the experience of the last twenty years suggests this is unlikely. It is telling therefore that more and more scientists of consciousness are advocating panpsychism, the idea that consciousness is universal and may even be an organising principle of the universe[9]. Consciousness and the failure of the classical world view to account for it was a feature of all the dialogues included in this book. Sarah & Ton discussed the problem with the classical view of man with Alex Wendt:

7 In Dutch, the word *bewustzijn* refers to both consciousness and awareness. Therefore, the difference in meaning is not an issue in the dialogues with Herman, Herma and Erik.

8 See for example an editorial in 'Frontiers in Psychology' by two leading consciousness researchers entitled 'Still wanted: the neural mechanisms of consciousness'.

9 For example, the 2014 article in *Scientific American* by Christof Koch, the chief scientific officer of the Allen Institute for Brain Science in Seattle. See References & further reading.

Ton Baggerman: [...] my clients are much more interested in working around meaningful wholes than my colleagues in psychiatry, who are trained to think in terms of chemicals, protocols and the DSM.[10]

Alex: Yes, that is a very mechanical materialistic view of the human that I find completely alien.

Sarah: It has nothing to do with the human experience.

Alex: Nothing! The problem with the classical model of man is that classical man is dead. Classical physics was specifically designed to model non-alive phenomena. If you use that model to talk about human beings, you are basically talking about people as if they are dead.

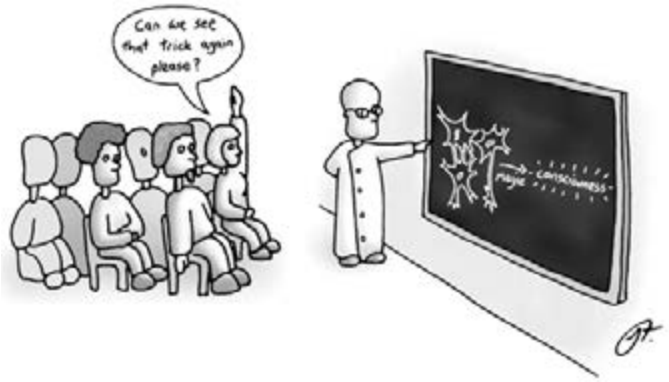
Henry Stapp made a similar point in his 1993 book 'Mind, Matter and Quantum Mechanics', where he described that according to the classical view of reality people are essentially zombies, or 'walking automatons', as they have no consciousness or free will:

This rigid enforcement of the classical physical laws entailed [...] that men's thoughts could have no effects upon their actions: that each human body, being composed of pre-programmed atoms, is an automaton whose every action was predetermined, long before he was born, by purely mechanical considerations, with no reference at all to thoughts or ideas.[11]

For Sarah, the problem of consciousness has been a theme in her life. In talking to Ton, she told him how she became interested in this puzzle:

10 The DSM (Diagnostic and Statistical Manual of Mental Disorders) is published by the American Psychiatric Association and aims to supply a set of standardised criteria for the classification of mental disorders. It is relied upon heavily in psychiatry, by clinicians, pharmaceutical companies, policymakers and legislators alike. The latest version, DSM-5, appeared in May 2013.

11 Mind, Matter and Quantum Mechanics, page 183.



My interest in consciousness stems from my teenage years when I began to wonder how it was possible that I feel like a self inside a body, and not like a body creating a self. That is how I became interested in the brain and brain function. I read psychology at university and naturally gravitated towards neuroscience. I had a very scientifically oriented upbringing and for a long time I thought the answers to these questions were to be found in science. We have such beautiful techniques, can image the functioning brain and even track neurotransmitter systems in action. But eventually I realised that all the research we were doing, and that I was doing, was not going to lead to us discovering the neural basis of psychiatric symptoms. That is because psychiatric symptoms are considered to be emergent, in the same way that consciousness is thought to be emergent, a mere side effect of brain function. Neuroscience cannot explain these strongly emergent phenomena.[12] And my gut instinct was telling me we need a new model of consciousness.

12 Strong emergence is a form of emergence where the constituent parts are not recognisable in the emergent phenomenon. Consciousness is considered strongly emergent as aspects of the physical brain (or body) are not recognisable in it. Sand dunes are an example of weak emergence, where sand, water and wind come together to form them, albeit in unpredictable patterns (hence the term emergence).

Ton: So you found that you had assumed that your work, and science more generally, would provide the answers to your questions and that it was too limited?

Sarah: Yes, I came to the conclusion that psychiatric research has not been able to explain the emergence of psychiatric symptoms from biology. So I started to look at consciousness research, a relatively new field that developed in the 1990s after Francis Crick[13] spoke out and said that consciousness was a phenomenon worthy of scientific research, and by now the field is 25 years old. It faces the same problem as psychiatry: there is no answer yet to how consciousness emerges from brain function. They are going round and round in the same circles as we are.

Ton: Do I understand correctly that you think you have a greater chance of finding answers if you take your gut instinct seriously? So, is what you are saying that modern-day science asks the wrong questions?

Sarah: I am saying that modern-day neuroscience uses the wrong model. The model is 'we are our brain', which basically states that our consciousness is the result of brain function or even an artefact of it. It renders us zombies in a purely physical world, with physical form. It says our sense of consciousness is caused by our brains, and any sense of free will is an illusion.

In my thinking – and I have tried to limit myself to the nature of consciousness, rather than to address the nature of reality, because, let's be honest, I'm not schooled to address that. You may wonder whether I am schooled to address consciousness, but at least I'm closer (*laughs*) – but I do think, and that is what I hope to work on the next few years, that we are using the wrong model in neuroscience, including in psychiatry.

Ton: What is it that is wrong with the 'we are our brain' model?

13 Francis Crick was world-famous for discovering the double helix structure of the DNA molecule with James Watson in 1953. They received the Nobel prize for their work in 1962.

Sarah: Well, there is no definitive evidence that we *are* our brains. There is a correlation between what your brain does and what you experience. But it is a huge assumption that what the brain is doing is *causal* to what you experience. And not only that it is causal to your experience of who you are and how you are, but also to the experience of seeing the teapot on the table. I see the teapot because of what my brain is doing. There is some truth to that of course, because if my brain were to stop working right now I would no longer be able to see the teapot. But there is this assumption that there is an objective external reality, a 3D world with a teapot in it that I also walk around in, and that when I see the teapot it is a somehow realistic rendition of it. All those sorts of assumptions…[14]

Ton: … they are simply not discussed, there is a lot more to say about them? It sounds like all sorts of philosophical considerations are just not taken into account?

Sarah: That's right.

Ton: So, neuroscience just ignores that reality is much more complex, ignores ontology?[15]

Sarah: My field, psychiatry research, tends to. The field of consciousness research takes it into consideration more. There you have philosophers of mind who think about these issues. Some of them seem to be gravitating towards panpsychism as a mechanism for consciousness. Chalmers[16] has said that the bottom-up explanation of consciousness emerging from brain function is simply dissatisfying, because it does not address our

14 This type of assumption of an objective (external) reality is relatively common in the natural and biological sciences, but contrasts with relational theory approaches that place more emphasis on the relationship between observer and observed or between agents. These are more common in philosophy and social sciences and include phenomenology, but have also been applied in physics, quantum mechanics and biology.

15 Ontology is the branch of philosophy that deals with the nature of being and reality. Asks questions like what entities may be said to exist. See Lexicon.

16 David Chalmers is a well-known philosopher of mind working in the area. See https://en.wikipedia.org/wiki/David_Chalmers

experience. It does not address why it is *like* something to be human.[17] There is a qualitative aspect to being alive: when we see red, we experience redness, the same for other colours, or for music or for beauty. Such subjective experiences are called qualia. Similarly, it is *like* something to be us and neuroscience has no explanation for that, or for any qualia for that matter. Chalmers has suggested that we should consider consciousness a fundamental property of our universe, in the same way mass and energy are fundamental. That at least brings it into the realm of scientific investigation.

Herma is a Jungian psychotherapist and has been working on the mind-body connection. This is what she said about it:

I am currently running a course for health professionals with two people who are very experienced at using the physical angle to address blockades in your body, particularly those that arose before you had language to express yourself. In the West, if someone has a stiff neck and shoulders, we massage them. That way, you are assured clientele, because they need to come back every two weeks! In Eastern medicine, they see that sort of tension as an imbalance in energy, where too little energy in the opposing area early in life led to the blockade. They then relax it by just touching the client in that area and instructing him to breathe towards it. By doing that you can redirect energy to a neglected area. If you do that, you can feel them relax. It is even reflected in our language. For example, in Dutch, we have a saying 'I am holding onto my heart' to express nervousness or anxiety.[18] But if you let go of your heart, enlarge your heart, the tenseness in neck and shoulders relaxes. Those are beautiful things to learn, to experience with a small group of people working together. That is the real body/mind connection…

17 Originally in the *Journal of Consciousness Studies*, in 1995. See References & further reading.

18 *Ik houd mijn hart vast* in Dutch.

I can still be surprised by what it can do. People don't need to regress to their childhood, to the way things were at home, to investigate whether their parents were good to them and all that. People can just be in the here and now, breathing and crying and it can be a healing experience. It can be beautiful.

Ton is a psychotherapist, and therefore works directly with people and their perception of 'being someone'. When Sarah and Ton first discussed this book in late 2015, he put it like this:

Sarah: Do you see the beginnings of the shifting paradigm that the other contributors to this book mention in your own field, of psychotherapy?

Ton: Hardly! Psychologists have always been keen on finding scientific grounds for what they do. I think basically that is overcompensation for the unscientific or at least un-Newtonian scientific aspect of working with real problems of real people. Of course what actually happens in psychotherapy is never going to be quantifiable and predictable in a classically scientific way. I think every psychologist knows that. But to be taken seriously as a profession, we have to keep up appearances and be scientific about it. And that has always meant classically scientific. As such, psychologists are not very likely to be the first ones to adopt a new paradigm since they already feel vulnerable to criticisms of being unscientific.

Sarah: How then do you think the classical paradigm has been translated to psychotherapy?

Ton: One way is by classifying our clients' problems in terms of 'disorders'. There is a system of classification, the DSM – Diagnostic and Statistical Manual of Mental Disorders – that has been the standard for decades now. It started off as a kind of inventory of frequent patterns of behaviour. It was meant to enhance professional communication in psychiatry. The way it is used now suggests that like in medical practice, clients' experiences and problems and the way they go about dealing with them, are disorders. And just like in medicine, we all want to fix a disorder,

don't we? So, this suggests that if we apply the right medicine or protocolled therapy to a specific DSM disorder, it will be cured.

It is a profoundly classical mechanistic way of thinking about the human condition. And it is so very convincing too, because it has so often been very successful! Even now as I am saying this, I am thinking: how can you disagree? What could be wrong with thinking about it in this way?' It makes me anxious to even suggest I might not agree. I worry I could be caught in the act, and be put away as a quack. That is how commonplace and dominant this classical approach has become.

Sarah: So, what do you consider the limitations of applying the classical paradigm to psychotherapy to be?

Ton: Well, first of all we know from modern-day quantum physics that the classical paradigm is wrong in assuming that mind does not affect matter. Our intentions and the way we attribute meaning in our lives affect our surroundings in a very real way! In my field, where mind is so very prominent, we need to broaden the classical paradigm to include it as soon as we can. Now that is the kind of meta-argument you can respond to by saying that as long as it works, it doesn't matter which paradigm you use. And it is hardly an issue anyway since the classical way of looking at the world has become automatic and self-evident.

A more direct argument has to do with the importance of the common ground on which client and therapist work in the context of therapy. I think we therapists can do much better than to define therapy as essentially talking to a client who is no more than a bunch of non-living atoms. For one thing, that is not at all the experience the client has, or the therapist for that matter! So, there is a lot going on in therapy that the therapist is not supposed to use if she adheres to professional standards. That is twisted and it hampers the therapeutic process. I think we should be keen to investigate new scientific insights that will allow us to take our experiences and consciousness seriously. And such a scientific paradigm is here already,[19] there is no

19 Ton is referring to quantum mechanics.

question about it! We need to investigate it and its implications for opportunities to become better therapists.

There will be more on how a new world view might help explain consciousness in Chapters 4, 5 and 6. For now, let's follow Ton's lead and turn our attention to modern-day physics and its implications for the way we view the world.

Modern-day physics: where 'in with the new' does not mean 'out with the old'

The second clue that we need a new world view comes from developments in physics in the twentieth century. At the beginning of the last century, there were monumental shifts in physics that have had a major impact on modern-day physics. One might argue that the developments sparked by these discoveries culminated recently, when Nobel Prize winner Gerard van 't Hooft[20] and colleagues published a paper questioning the existence of locality and causality ('t Hooft et al., 2016) and Erik Verlinde used his theory that the underlying structure of reality is information to predict gravity as an emergent phenomenon from it (Verlinde, 2016). This was remarkable as it forgoes the need to postulate dark matter as a means to make the math of galaxies and the universe work. At this point, this theory has not yet been supported by astrophysical observations, but it does illustrate what a shift in thinking can do to a scientific field and how great the consequences may be.

In talking to Erik Verlinde about his work, he said the following about why we need a shift in our thinking about the physical realm:

20 Gerard 't Hooft and his former mentor Martinus Veltman won the 1999 Nobel Prize in Physics for elucidating the quantum structure of electroweak interactions.

Newton and his contemporaries had a very mechanical world view, and it allowed them to affect some very concrete things in the world around us. For example, engineers that build cars use Newton's laws to do so. Anything we build in our world, bridges, houses, dams, it is all based on Newton's laws. Furthermore, we are not saying Newton's laws were *wrong*. Even Einstein, when he said it was time to replace Newton's theory of gravity did not say it was wrong. He just said that in certain circumstances things worked differently. There are always data that do not fit the theory. But I think in cosmology we are seeing rather a lot of data that do not fit the theory. We are moving towards a new description and theory.

I think everybody asks themselves now and then 'where does it all come from?' How does the universe fit together is a question that people ask themselves. There is a cartoon by Sidney Harris of a man by a big telescope. In the first half of the cartoon, a caveman is looking at the stars. They are both wondering 'where did it all come from?'

We have always asked that question, it is what led us to try to find out how everything fits together, and it is what led us to develop beyond cavemen. All the technology we have developed

was ultimately motivated by that question. But it is a question we still haven't really answered.

The two early twentieth-century discoveries that are at the base of the current shift going on in physics were Einstein's theory of General Relativity and the formulation of quantum mechanics.

In his Theory of General Relativity, published in 1915, Albert Einstein argued that space and time are neither independent nor absolute. Instead, they are closely related to each other and subjective: two persons travelling through space at very different velocities experience different courses of time. Apparently, some of the characteristics of an observer – speed, in this case – affect what is observed. But how is that possible if time and space are absolute and independent, as classical physics has always assumed?

Another fundamental shift in physics arose in 1900, when Max Planck discovered that energy comes in basic, fixed minimal 'packages' instead of as a continuum that can be further subdivided infinitely.[21] At first glance, this might seem to confirm the classical idea of a nature being composed of 'building blocks'. However, Planck's discovery posed some serious problems to Newtonian science: first, it meant that the assumption that nature could always be further reduced was wrong. Up until that time, physicists had assumed that one could always take the analysis down one further level if one could only build a better measuring device up to the task. Planck's discovery defined the lower limit of precision for any scientific measurement, simply because – by definition – it is impossible to design an instrument of sub-quantum size. When Sarah & Ton talked to Henry Stapp, he gave a brief history of quantum physics which they share with you below:

21 Max Planck won the Nobel Prize for his work on quantum physics in 1918.

Henry: In 1900, Max Planck was studying the properties of electromagnetic radiation, and discovered that the world had properties that were incompatible with the ideas of classical mechanics: energy came in minimal quantities (quanta) and sometimes behaved like particles in addition to waves. Then Einstein discovered the photo-electric effect and this emphasised that visible light, which at that time was thought only to behave as waves, also had particle-like characteristics.[22] The next important step in the development of quantum mechanics was Bohr's 1913 model of the atom.[23] In this model, the atom is like a miniature solar system, similar to the way it is still taught in schools today. But the orbits of the electrons around the nucleus turned out not to spiral into the centre as classical mechanics predicts. In fact, gravity did not appear to have an effect on them at all. Instead, they stayed at a certain distance for a long time and then suddenly jumped to another distance with the emission or absorption of a photon. So, this model accommodated some of the basic quantum-mechanical properties that had previously been discovered: radiated energy comes in discrete packets that enjoy both wave-like and particle-like properties.

But it turned out that when they looked at the model in more detail, they couldn't make it work. There were a lot of different experiments and if you added details to the model to explain the results from one experiment, then it could no longer explain others. Nobody was more keenly aware of this than Niels Bohr, who had invented it: as the inventor, he was of course particularly concerned whether it worked or not. Then the young Werner Heisenberg[24] came to work with Bohr in Copenhagen and he was surprised. He had previously worked with Somerfeld and Born,[25] and they thought that it was a great model and that it worked, but Bohr had realised that it did not. Heisenberg, still

22 Albert Einstein received the Nobel Prize for this discovery in 1921.
23 Niels Bohr received the Nobel Prize for this work in 1922.
24 Nobel Prize for Physics 1932.
25 Nobel Prize for Physics 1954.

young and full of energy, pinned the problem down to the idea that the process of acquiring knowledge about the atomic system was in fact changing the system, an idea known as the observer effect. Furthermore, there was a limit to the accuracy with which complementary properties of the system could be measured, the uncertainty principle. Up until that time, people regarded observing trivially: it was commonly believed that you directly grasped the reality behind your experience. However, Heisenberg determined that the process of acquiring knowledge about a system actually *changes* the properties of the system you are inquiring about. So, that brought human consciousness into the dynamics in an entirely new way: these new insights were not just about an observer disturbing the object of observation, it was about actually causing changes in what you were observing.[26]

To illustrate what this means with an example: in order to see an electron orbiting the nucleus of an atom we shine light on it. The light is then reflected by the electron and captured by our microscope. If we want to observe the electron in its natural state, we cannot use too much light, because the energy of our light beam might push the little electron out of its orbit, leaving us with the observation of it fleeing the scene. In fact, in order to be able to see the electron in orbit, our light beam would need to be smaller than one quantum of light and – as Planck had discovered – that is impossible.[27]

26 The most widely accepted, original interpretation of quantum mechanics, known as the Copenhagen interpretation, does not reserve a role for consciousness per se, and neither do the two currently widely adopted interpretations, the realist and instrumentalist interpretations. It is an ongoing debate in quantum physics whether conscious measurement is necessary to collapse the quantum probability wave, or whether a non-conscious measuring instrument suffices. Henry Stapp is one of the quantum physicists who argues conscious measurement is necessary, along with Paul Dirac (Nobel Prize 1933), Niels Bohr (Nobel Prize 1922), Wolfgang Pauli (Nobel Prize 1945) and even Max Planck himself.

27 Example borrowed from Werner Heisenberg in his 1962 book *Physics and Philosophy*. See References & further reading.

Henry continued: The key point to understand here is that this discovery placed the observer and his choice of question directly in the dynamics of the system being observed. And this was back in 1925! This was the key innovation in the transition from classical mechanics to quantum mechanics, the very idea that our probing action – we do an experiment designed to probe some properties of a system – changes the system we are probing. The implications are huge and have not been carried over into our current scientific thinking.

As is perhaps evident from the number of Nobel Prizes awarded in the area, quantum mechanics has been catalysing new insights and developments in physics, as well as philosophy for over a century now. Within physics, the classical concept of a world full of elements that exist independently of one another is no longer tenable. The certainties of objective and infinitely replicable cause-and-effect relationships have had to be abandoned, in favour of a relative and probabilistic paradigm. In the weird world of subatomic particles, they do not exist as objects. Rather, they pop into existence, at different locations, as a result of measurement, and they can be 'entangled' with each other, where measuring one instantly determines the fate of the other. This interaction is instantaneous, meaning that information is transferred faster than light, and as such it is not causal in the classical sense. Einstein famously called this 'spooky action at a distance'.

One of the most difficult aspects of quantum physics to grasp from our classical way of thinking is that *measuring* a particle is what causes it to take shape. It is the act of observing that brings it into existence. Until then it only exists as a 'probability', or a likelihood. This is crucial, because without an observation, there is no reality to observe, only a probability. This aspect is what has led Henry Stapp – as well as some other leading quantum physicists – to argue that consciousness is central: there needs to be somebody (an observer) to make the observation. Of course, it is possible that this need for an observer to bring reality into being

only applies to the tiny scale of subatomic particles. However, that seems unlikely, as our larger, directly observable physical universe is built up of particles that are made of atoms that in turn are made from these subatomic particles. Furthermore, it seems strange that reality would take on different physical forms depending on the scale. And finally, it is notable that the math of quantum physics is now being used to study human cognition. For example, in the field of psychology quantum math has been shown to predict the way humans make decisions better than classical probability theory, solving some of the paradoxes in the field (e.g. Bruza et al., 2015). One of those is the so-called Linda problem: here subjects are asked to rate which of two options is more likely. They are told that Linda is a bright and outspoken woman who participated in demonstrations against nuclear weapons and discrimination in college. They are then asked which is more likely, (A) that she is a bank teller, or (B) that she is a bank teller and active in the feminist movement. Subjects reliably pick option B, even though (according to classical probability theory) the conjunction of two probabilities, both of which are smaller than 1 should always be smaller than one of the constituent options. Quantum math on the other hand predicts that option B is the more likely outcome.[28] The math fitting does of course not mean that human cognition is a quantum phenomenon, but it is suggestive that quantum processes have been shown to be involved in a number of biological processes, including photosynthesis and the ability of some migratory birds to navigate.[29]

Overall, the implications of quantum mechanics for our understanding of the world at our scale are yet far from clear. However, it is noteworthy that some of the quantum phenomena that seem so strange to us at first glance are actually similar to

28 For a full explanation, see the paper by Bruza and colleagues listed in References & further reading.

29 For a comprehensive and very accessible account, read Al-Khalili & McFadden's *Life on the Edge*.

events we encounter every day, for example in social interaction. In the dialogue with Herman Wijffels and Herma van der Weide, Herman noted:

I am reading a book on quantum biology. What is fascinating is that the quantum world looks very different than the world we perceive. In it, you have entanglement[30] and superposition[31] for example. I suspect those phenomena are equally present in our world. We just cannot observe them if we use our usual, classical outlook. That is the real point, that we have a certain outlook and therefore perceive the superatomic world as being very different from the subatomic one. In the subatomic world, there are quantum processes that we are beginning to uncover scientifically. Something happened this week, and I said to Herma: 'this reminds me of subatomic entanglement'…

Herma: Yes, one of us was thinking something and the other said it.

Herman further underscored that we need a new scientific paradigm, saying the old one is so engrained we seem to have forgotten it is a paradigm at all. To some people, it seems to be beyond question that the classical world view is the true shape of reality. He also pointed out that needing a new paradigm does not mean that we should do away with all aspects of the old one. It is not that the reigning paradigm is completely false. Rather, it is incomplete.

Herman said: Some people say everything is going wrong, that we have done it all wrong, with the environment, for example. That is not the way I see it. I think the scientific paradigm that

30 Entanglement is the tendency of quantum systems to be entwined in such a way that when a property is measured for one of them, the value for the other is simultaneously determined regardless of physical distance. See Lexicon.

31 Superposition is the property of quantum systems to be in two states (or two locations) simultaneously. When measured, the system 'collapses' into one or the other state. See Lexicon.

we have been using has been very productive. It was exactly what we needed at this stage of our evolution.

To put it very prosaically: until the Middle Ages, people in Europe, in this part of the world, believed that as long as you did what the church said, you would go to heaven and be rewarded there. With the Enlightenment, certain people stood up to say: 'Maybe we can think of a few things to make it pleasant here, on earth, too.' I may be putting it a bit bluntly, but it is essentially what happened. People like Descartes and Newton worked on these ideas, and they were very productive. It resulted in increased awareness. But the effectiveness of that formula became problematic when it became so successful that we started to change our circumstances in a meaningful way. Now we are ready for the next stage in our evolution, to develop more awareness of how we shape our world. The way I see it is: the scientific paradigm was good. But as always when something works too well, it was so successful that at the end of its life it has started to lead to perversion, and it is therefore time to move on to the next paradigm. I view everything that is happening in the world in that light.

Let me give you an example: both socialism and capitalism are materialist daughters of the Enlightenment. Pure socialism has already disappeared. The odds are that capitalism in its pure form is also going to disappear. We are simply ready for the next phase. What is important now is how we develop our awareness and that we let go of paradigms that belong to the past era, such as atomism[32] and the dichotomy between body and mind. We must let those go. It is all about finding the trans-position. We should not abandon rationalism, but we need to become trans-rational. Really, it is the next round of bringing awareness into matter. So, of course, it raises a question that was unsolvable in the past: What *is* consciousness? What *is* awareness? Is it something that arises from matter, or is it something that precedes it?

32 The idea that everything is separate and independent. See Lexicon.

Alex Wendt said something similar when asked why the new paradigm is taking its time to take hold.

Sarah: Quantum physics has been around for a century. But it has taken a long time for these ideas to begin to penetrate. Why do you think there is so much resistance? Obviously, some of these ideas are very complex, but they have been around for quite a while now.

Alex: I think part of it is that there are principled arguments that these quantum effects should not appear at the macro-scale, because of decoherence[33] and other quantum effects. So there is good intellectual reason to be sceptical. However, I think a lot of the resistance is sociological. People have invested careers and graduate training in a certain way of thinking. And it happens to be a way of thinking that works pretty well! So there is no reason to give it up quickly. Also, there is a kind of 'new-age' feel associated with the quantum work. That doesn't help. But I think it is just a matter of time. I am an optimist. I look at my students and they are quite interested. My colleagues? Less so. But then, that is exactly what you would expect.

Erik said something similar: There is a lot of philosophy behind this that I think many physicists are probably not ready for. They like to look at equations. And they learnt all sorts of things from textbooks that they are persisting in…

Sarah: I think that applies to scientists more generally…

Erik: The shift in thinking is happening very slowly, because people hang onto their old ideas.

Erik also expressed his hopes for what a new paradigm might bring us: I hope this new paradigm will bring us closer to a new answer to that age-old question. If you ask people out in the street today 'Where did this all come from?' the majority would

33 The tendency of quantum systems in superposition to collapse into a 'classical' state as a result of interaction with their environment. See Lexicon.

say ‘from the Big Bang’. Because that is the story we all learn in school.

Another Sidney Harris cartoon I like shows a room of people listening to somebody preaching about the Big Bang ‘It was HOT, and then there were all these Quarks, and…’ and they shout ‘Hallelujah’. It makes the point that the theory has almost become a religion.

Religions arose to answer that same question: where does it all come from? It is part of our nature that we want to have some sort of genesis tale, an origin story. I think the big bang theory is a scientific version of that tale, but now positioned at a specific point in time. But to me, logically, it makes very little sense. How can something arise out of nothing? And there are other problems with it. There are all sorts of things that bother me about it conceptually, and I hope and expect that the direction we are taking will provide a different answer. I think emergence will turn out to play a big part in that, because the phenomenon of emergence shows us that things don’t come out of nothing, but that they always come out of something. So, another way to

ask the question 'Where did it all come from?' is to ask 'What is the underlying language, the underlying structure of reality?' So that is my hope, that if we ask people in the street a century from now 'Where did it all come from?' that they will give a different answer.

We are part of life on our planet

From the above, it is clear that everybody who participated in these conversations feels we need an extension of our scientific paradigm, because our understanding simply does not explain all the data. Perhaps however, the limitation of the old paradigm is clearest in the crises we are currently facing on our planet. Our mechanistic, materialistic way of thinking has led us to capitalise on the resources of our planet. It has brought us our modern way of life, with relatively great wealth, science, healthcare and industry. But this approach is also reaching its limits as is evident in the environmental and humanitarian crises we are facing. Perhaps that is the most urgent reason we need a paradigm shift: not because of academic debates on the nature of consciousness or the possible implications of quantum mechanics for our understanding of ourselves, but because we need to realise that we are part of the system that is our planet and our behaviour affects our surroundings. In speaking to Herman and Herma:

Herman: One example is that in the industrial age, mechanics were the most important metaphor. The challenge was to fit people within that metaphor, and the result was rather forced, with human bodies envisioned as machines that could be fixed when broken, for example. Now the time is arriving that we need to use organic metaphors, where things are organised in an organic, natural way. We are moving away from pyramids and hierarchies to network organisations. Instead of having energy production and distribution centralised, we are moving towards harnessing energy everywhere, and distributing any surplus through the

network: that turns it into an organic system. This principle will apply to many things; the world will self-organise in the next era. The Internet is an example of that. In fact, it is probably the best example we have. The world is going to change following the example set by the Internet. One consequence will be that the meaning of traditional national states with boundaries will decrease. The stately organisation is an industrial invention stemming from the industrial era and industrial thinking.

I consider the European Union an exercise we are conducting to learn how to live in a context where the national borders still exist, but no longer determine everything. Of course, that understandably also leads to an opposing tendency, a nationalist reflex if you will.[34]

Sarah: Of course, a backlash.

Herman: But every time there is a problem, we come to the wrong conclusion that we need to solve it ourselves. What we need is to collaborate! That doesn't just apply to Europe; it applies at the global scale. We need to realise that the problem we are facing is a global problem! We need to address it globally. It is this sort of thing that the current increase in awareness is about. The throngs of refugees arriving on our shores are really telling us: 'People, we have a global problem! If you come to our homes to fight, to take away our energy sources (oil), then you will find there are consequences.' So that is the message: 'Address the situation! You need to shift to producing your own energy as soon as possible.'

Currently, the world is full of signals like that. Only we keep trying to reduce them to our classical world view, our classical paradigm and it no longer fits.

Alex had the following to say on states and the nature of 'statehood': One of the criticisms of my International Relations work was that I ignore the uncertainty states have regarding another

34 Note that Herman made this comment in October 2015, well before the Brexit and Trump winning the US presidential election.

state' intentions. My response was: Well, actually there is not that much uncertainty out there. States are pretty certain most of the time what the other's intentions are. Some theorists (realists) have had to exaggerate the difficulty of knowing intentions in order to make their theory work. Clearly sometimes we don't know the other's intentions. We do get tricked sometimes. But my guess is that Canadian leaders never doubt that America is not going to attack them tomorrow.[35] There is just no uncertainty there. I think that is probably the norm rather than the exception. And that would follow from entanglement at the state level, by which I mean that there is shared, collectivised knowledge. In such a world view, there would be a lot less uncertainty and therefore a lot less conflict.

In all, I think accounting for such shared knowledge is going to require a complete shift in our world view. Not only of our relations among ourselves, but also of the way we perceive our relationship to nature. Our view is going to have to become much more about stewardship, organic in its nature. It is not about dominating nature and forcing nature to reveal her secrets. These kinds of metaphors are just all wrong.

Sarah: Unhelpful?

Alex: Unhelpful, yes.

Ton: They have reached their limits.

Alex: Yes!

Herman added: One of the biggest facts of our time is that we people have a multitude of ways to end life, and on a great scale. In the history of mankind, we have never had so many methods available to us. We have atomic bombs, biological weapons, but also to just keep on living the way we are. But I think the most logical interpretation of the purpose of life is to make the best of it, to pass it on as best we can. Maybe there will be a global disaster with a meteorite, similar to what happened with the dinosaurs that opens up new avenues for life. It is possible. But until it does, it

35 This statement also predates Trump winning the 2016 US presidential election.

is our job[36] to make something of it, the way people usually want to with their own lives. That is why I am so invested in sustainability.

Herma: It is urgent, too, if we want to continue in this form. At the same time, there are films of life being born on the South Pole in deep groves under the sea, forms of life that have been dormant there for millions of years, they are beginning to appear. They will stay there until the earth changes so much that they get their chance to develop.

Herman: One possibility is to resign ourselves to what is happening. If we keep this up, it will be a journey to the end of the road. But on the other hand, we have acquired all the insight, all the knowledge and all the technology we need to live decently. What is necessary now is that a critical mass of people becomes aware. For that, we need to provide information. We need to offer enticements. There are all sorts of ways. People who are in a position to need to set a good example, to make the change necessary. Take energy, for example: the way the energy market currently is means that in large parts of the world, solar energy is actually the cheapest form available. Yet it is hardly used, because people are not aware and it is in the interest of gas companies not to inform them. And it continues! In terms of resources, in thirty to forty years' time, we should find ourselves in a situation where we have a surplus of energy available. If we have a surplus we can then apply it to other purposes, such as desalinating seawater. That water could then be used to irrigate deserts, which will in turn boost the available biomass. That way we can provide not only more food but also materials for making new products, chemically etc. In short, the field that is opening up is full of opportunities!

Ever since the Enlightenment, we have developed a very linear approach. We think linearly, we organise our society linearly. But in fact, reality is made up of circular processes! So, we are

36 In Dutch, Herman said *opdracht*. A (perhaps unintended) reference to the bibliography Jan Smit wrote about Herman's life that carries the same title. It translates as 'The calling, or the many faces of Herman Wijffels'.

intervening in a circular world using linear processes. That was alright when there were so few people on earth that the planet was essentially an infinite source for them. But that is no longer the case. So, our job is to transform ourselves from the linear creatures that we have become, to change our ways so that they fit in the circular nature of our environment again. And that basically applies to all areas. So, healthcare needs to do what the term suggests: take care of our health, instead of intervene once it has gone wrong. Healthcare as we know it is heavily biased towards curing, not preventing. Of the 90 billion Euros we spend on healthcare annually in the Netherlands, 86 billion goes to curative interventions. So, that is how I view the world. We had a good model that worked well for a while, but now it doesn't fit anymore. We are ready for the next release in the process of civilisation that makes up the history of humankind.

In conclusion, in the dialogues that make up this book, all participants shared the view that it is time to reinvent our scientific paradigm, so that there is no longer a gap between 'us' and 'nature', or between 'us' and 'them'. Our new paradigm will need to address why it is *like* something to be us, to be conscious. It should be less mechanistic and more organic, and, as we have seen, the people in this book share the intuition that developments in physics may provide part of the basis for it. In the remainder of this book, the contributors speculate what form this paradigm might take. However, first we need to reflect on language. One of the most difficult aspects of writing this book – and of having these dialogues – was finding common terminology. Too often the participants spent a lot of time explaining what they were trying to say, using the same terms for different ideas or different terms to express the same idea. The next chapter addresses this problem, and discusses the approach taken to deal with it.

3 The paradox of language

Language is paradoxical. Intuitively, it is tempting to speculate that language developed to help people understand each other more easily and with speed. Certainly, it is the case that in our everyday lives we acquire our second-hand information through language, whether a friend tells us a story, we watch the evening news or browse the Internet. The paradox lies therein that language can also confuse.[37] The intention of the sender (the one speaking or writing) is not always understood by the receiver. There is hardly a need to illustrate this with an example: we can all think of instances where we have been misunderstood by those around us. There can be many reasons for such misinterpretations: expectations, assumptions and frame of reference may differ between sender and receiver, or they may simply differ in the meaning they ascribe to certain terms. It is a paradox that a tool designed to improve understanding between people can at times have the opposite effect, and lead to greater misunderstanding.

Sarah & Ton encountered this time and time again in compiling this book: they come from different backgrounds and spoke to people from very different disciplines. Different terms were used to describe similar notions, or in some cases the same terms were used to describe dissimilar concepts. For example, we have already encountered the term 'classical world view' in Chapters 1 & 2. There are a lot of different terms that differ in their specific meaning but all contribute to describing what this classical world view is. Some of these are 'atomistic' (made up of separate particles), 'Newtonian' (based on physics derived from Newton's work), 'Cartesian' (stemming from Descartes' work, with matter and mind considered separate entities) and

37 Language and the problem of shared meaning or understanding are topics on which there is a large, philosophical literature including work by Wittgenstein, to name but one, on the problems in attributing meaning to the words of another.

'materialistic' (built up out of matter). All of these terms can be used to describe the classical world view, yet it is clear that they have specific meanings that are distinct from each other and that seemed largely to be understood in a similar way by the participants in the dialogues in this book.

In other cases, the distinction in meaning between certain concepts was less clear. For instance, Ton often uses the term 'formative tendency', which he borrows from Carl Rogers, to describe the tendency of information to organise itself into coherent wholes.[38] Rogers refers to people who do the same thing as actualising their potential. Henry in contrast, speaks of actualisation as what happens when a quantum wave collapses to create reality (more on that later) and about 'the sufficient reason principle' to express the idea that nature may favour certain outcomes above others. Here similar terms are being used to convey related but subtly different meaning (actualisation in two flavours), while different terms are used for similar ideas (formative tendency and sufficient reason principle).[39] As you can imagine, the participants in these dialogues spent quite a lot of time establishing common terminology. It did not help that the ideas they were talking about are new, often still largely based on intuition and that therefore there *is* no established common vocabulary to describe the emerging picture! To make things easier for the reader, a lexicon is included at the end of this book to define what is meant by the various terms that you will come across in this book.

Furthermore, the paradox of language extends beyond the potential for attributing different meanings to different concepts. Sometimes *assigning* language to a concept is sufficient to move

38 Carl Rogers was one of the founding fathers of client-centred psychotherapy, the area Ton works in. In Rogers' terminology individuals can actualise to fulfil their potential. Formative tendency is his term for a more general tendency toward growth, not limited to humans or living organisms per se. See his 1980 book *A Way of Being*.

39 These terms are in the Lexicon and will be explained in more detail in the upcoming chapters, as they become relevant.

it away from its true meaning, as it can – through association and the activation of other concepts – move the speaker further away from what she is trying to say. Herma van der Weide said the following about this:

Language may move away from meaning...

I am writing a book on exactly the problem we are talking about: semiotics. There are observations at different levels, like this table (*knocks on table*). We look at something and that is called first. Then you can label it 'table'. You have the object itself, as well as the word describing it. That's called second. The experience of hearing the word describing it has nothing to do with the object itself, but merely refers to it. Then if I say 'there's a white table in the middle', I am thinking about what is going on with the table and transferring that thought through language. That is called third. If you realise that and then realise that you will perhaps see as many as 100,000 tables in your lifetime, then you see that the concept 'table' may change 100,000 times. In mysticism, the aim is to find the zero-level, to not name, interpret or even observe the outside world. Then you can connect to a very different sort of meaning that comes from inside, a meaning that is not distorted by attributing meaning through language. From there, you can connect to pre-language consciousness, a domain that we have not yet traversed. So, semiotics and mysticism are opposites. It is a great paradox: as soon as you apply a word to something, its purity is gone. Language plays an incredibly big part. That is why we need to connect on a deeper level.

Sarah: So, are you saying that the next step in the evolution of our consciousness should involve abandoning language? That we should only communicate through an underlying layer, because it introduces such confusion in daily life? Could we even do that?

Herman: It's a big thing in leadership development. Have you heard of Otto Scharmer's Theory U, and his book 'Leading from the emerging future'? His U-curve approach is really all about

tapping into the collective unconscious. You take problem A, and instead of crossing straight over to solution B, you descend instead into the collective in a number of steps and at the deepest point, you take yourself off into nature for a solitary retreat. Once there, everything is gone and you find your connection. And then from there you can ascend back to the surface and find your solution.

So, Herman and Herma spoke of language potentially separating us from the meaning intended. They pointed out that language is very much about how we understand and communicate our relationship to the world around us, a question that is also debated in philosophy.[40] The relevance of language for our scientific paradigm also came up with Erik Verlinde. He said:

… but that does not make facts fictional

One thing that makes me uncomfortable is the ongoing discussion, the suggestion that there may be facts and 'alternative facts'. I think we need to be very careful to not say that facts can be different for different people. That is what hard-core scientists find difficult to accept about quantum mechanics, that it makes matters subjective.

Sarah: But if you accept that we are part of a larger whole, part of a larger reality around us, then there are facts within the context of that system that apply within the system. Whether or not they apply outside our world, our universe, is neither here nor there, but they do within. People blatantly lying, denying certain events took place or creating new ones and calling them 'alternative facts' doesn't mean it is a fact to them but not to us.

40 For example, philosophy of language investigates the nature between reality and language, such as the nature of meaning ('what *is* meaning?') and in relational philosophy objects/events are only real (or meaningful) in relation to other objects/events.

Because it takes place within the system where everything is connected.

Erik: I suppose so, but it is well known that some things can apply for one person and not for another. If you have an event in a busy square and you ask all those present to describe what happened, you will get as many descriptions as you have witnesses.

Ton: That could be explained mechanically, even…

Erik: Yes, I think it probably could. But even so, you know that if an event goes down in the history books a certain way, the description is probably not fully accurate. The same applies to newspapers, what is written there is probably not entirely accurate. So, it is not that easy to maintain absolute facts.

Sarah: We talked to Alex about this too. He said that when you read the history books, they say things like a certain event was the beginning of the First World War. But for the people at the time, it wasn't at all! It may have been a terrible event, they even realised it was the beginning of a war, but they did not realise it

was the beginning of World War I, that was only with hindsight and human (re)interpretation.

It is true that it complicates matters enormously that people can assign different meanings to the same physical event, but that is different from lying about what happened.

Erik: Okay, but the point I want to make is that certain things can be seen as absolute facts. But a lot depends on language, because how exact can we make language? Some interpretations may be personal, but there are things that we try to define more precisely. That is exactly why we use maths in physics, so that we can agree that something is true or not. That is the point of logic too, to construct a universal language.

Erik raised an important point, that reserving a role for consciousness and our (human) interpretation of reality does not mean that reality appears different to everybody. There are shared observations. There must be, or we would have no means of interacting. Yet, different observers may make different observations, in addition to ascribing different language to them. In speaking to Alex Wendt, he raised another aspect of the role of language: our observations are affected by their timing relative to other events. Alex explained:

The chapter in my book I like the most is the one on time and how there are all these backward referrals going on. The way Clinton's emails were re-categorised after the fact as national security threats, whereas at the time they didn't seem to be a big deal. But there was this re-categorisation after the fact, which makes them something before.

Ton: So, it has to do with meaning?

Alex: Yes, that is right. And with stabilising that meaning. In order for meaning to be meaning it has to be stable.

Sarah: But you never know how stable it is going to be to the future, do you? If we move towards a society that is completely open in information and where states have no secrets, then at

some point in the future nobody will understand why there was ever a big deal about Hillary Clinton's emails.

Alex: That is true. I think the whole concept of retroactive re-description of reality is fascinating. Of course, a sceptic will say that all you really do is change your subjective descriptions of what objectively happened, that you did not in fact change reality after it happened. But I don't think that is right. I think that there is a deeper connection between us and our ancestors through the course of history. In a sense, we are still part of their story. A story that is unfolding and that continues to unfold through us and we are re-describing their story after the fact.

In sum, we use language to describe our reality and to communicate with each other in the context of that reality. The contributors to these dialogues agree that we use language to interpret and perhaps even to shape our reality.[41] Yet, there is the paradox that in doing so, we can become unintentionally further separated from our 'true' meaning[42] (or even intentionally in the case of 'alternative facts'). As such, you might consider that Sarah & Ton perhaps set themselves an impossible task in writing this book, in choosing written language as their medium, while they are aware that by definition they will not be able to get their true meaning across. It is for this reason that in the chapters to come, they have chosen to let the dialogue sketch the ideas. They have chosen to not (over-) interpret the ideas or to attempt to construct a full model from them. Rather it is up to you, the reader, to sit in on the discussions so that you can form your own thoughts about the ideas being brought to the table.

41 Similar to constructivism in philosophy, a movement that argues knowledge is based on interpretations and the relationship between conscious interpretation and reality.

42 'True' means either (what we would traditionally consider to be) an objective physical reality or the meaning intended by the sender.

4 Is reality what we make it?

So, by now we have established what our reigning paradigm is and heard why it is time to renew it. We have discussed that there are aspects of our reality that are simply not in keeping with the way we view the world: there is no convincing scientific explanation for consciousness; we do not understand how brain function can result in the experience of feeling like somebody. Furthermore, modern-day physics is telling us our world looks very different at the subatomic scale, where quantum systems have both particle and wave-like properties and only take on one or the other when they are measured. We need a new paradigm that can incorporate these as yet poorly understood aspects of our reality.

What shape should this new paradigm then take? We have already heard that it should build on our existing paradigm, but be more organic and circular and less atomistic and deterministic. The second half of this book explores the ways in which our understanding of the world is changing. It is not the goal to provide a complete picture of what science will look like in 50 years, rather the idea is to sketch an outline, with shadows here and there, leaving the reader to peer through the looking glass and make up her own mind as to what she sees. An obvious place to start is with the question how the probabilistic world of subatomic processes creates the definitive physical world we perceive around us. Erik Verlinde explained why reality appears as it does as follows:

Reality: just probabilities taking shape?

The reason our reality appears very classical rather than quantum mechanical to us – in terms of objects having definite positions for example – is through a process called decoherence.[43] When you think about it carefully, it also has to do with entanglement: if I

43 See note 30 and Lexicon.

have a bit[44] over here that is in one of two conditions (0 or 1) and I bring a measuring device close to it, what happens is that the outcome of the bit becomes entwined with the measuring apparatus. The apparatus is macroscopic and has so many conditions, lots of 0s and 1s, that the little bit no longer has its conditions. So really you are projecting your measurement by entanglement.

Ton: It becomes one system.

Erik: You can't see the other possibilities. The other possibilities disappear from the system.

Sarah: That's fascinating! I had never thought about it like that before. You're saying that when you do a measurement, the measurement apparatus becomes entangled with the system you are trying to measure. But then that keeps the problem going: If the apparatus has become entangled and you, as the experimenter, are outside the system, you still wouldn't know what the outcome of the measurement was. Would you? Not until you became entangled yourself…

Erik: That's right. That leads to dilemmas like Schrödinger's cat and the like…

Schrödinger's cat is a famous thought experiment coined by Erwin Schrödinger in 1935. It describes a cat in a box with a vial of poison attached to a monitor for radioactivity and a radioactive source. If the monitor detects a radioactive particle the vial is shattered and the cat killed. In orthodox quantum mechanics, the cat is interpreted as being simultaneously dead and alive until you open the box, at which point the system (cat) takes on one or the other value.[45]

Erik continues: My feeling is we have a very practical solution for that in quantum physics, but when you think about it philosophically: Is there a wave function collapse or isn't there?

44 The term 'bit' originally comes from computing and means 'binary unit'. It is the basic unit of information and may have one of two values, often denoted as 0/1.

45 Also see Lexicon.

Sarah: perhaps we are not thinking about it with the right paradigm…

Erik: Well… certainly the world is more quantum mechanical than we realise in our daily life.

The problem of how reality – as we perceive it at the scale of our daily lives – emerges from a subatomic probabilistic reality is something we discussed a lot. As Erik says above, quantum physicists have often described it as a quantum probability wave collapsing when a measurement is made. Yet, the mechanism of it is hard to understand. Ton said:

I think that when we observe something, it is our experience, at least for a while, that we have acquired some certainty and constancy. But then again, we all have plenty of experience with change and growth and decay, the sense that nothing stays forever, '*panta rhei*'.[46] So no, I don't think the wave collapses into some sort of singularity. Not ever. I think that reality always continues to be constructed of possibilities, at least in some sense.

In talking to Alex Wendt:

Ton: About this concept of the collapse of the wave function: It seems like it is still described in classical terms, as if a wave of possibilities is collapsed, stops being possibilities and is actualised into some kind of certainty, a singularity. But how can that ever be? How long can such a certainty exist, given that as soon as something *is*, it starts moving forward and changing again?

Alex: I see what you are saying… The claim is that chance becomes fact at that moment for that particular state. But clearly whatever it was that collapsed, immediately returns to a wave function state. It is constantly collapsing, constantly. Whereas the metaphor of a collapse makes it sound as if it is terminal.

46 Citation attributed to the ancient Greek philosopher Heraclitus, translates as 'everything flows'.

And you only get the terminal one when you die (*laughter*), that's the true collapse.

From the way I see it, what the wave function collapses into is our conscious experience. Each of our conscious experiences is the stuff that is being collapsed. And so each bit of consciousness, if you want to put it that way, would be a collapse. So, in that sense it is a continuous stream.

Ton: For how long?

Alex: That I don't know. A very, very short time.

Ton asked Erik more directly: What is a probability wave? How do you determine its boundaries?

Erik: Well, this is a century-old discussion about the interpretation of quantum mechanics. The new language of information we are developing is one that builds more on the more abstract language of quantum mechanics and does not concern itself with waves. Probability waves were introduced by Schrödinger to make quantum mechanics more visual. Bohr originally described it in terms of states, where you make jumps from one to the other.[47] And for that you don't need probability waves.

Ton: What sort of states?

Erik: Really it is nothing more than a way to describe a state. It gives you the probability of finding a certain result if you do a certain measurement. The probability wave is a complex measurement to measure the position of a particle. Intuitively that is fairly obvious, but it does mean there are lots of possible results, because the particle could be anywhere. So then you have to give the probability of finding it in each location. But if I have a 0 and a 1 there are only two possibilities. What are the odds of 0? What are the odds of 1? That is how we broke it down: we split up all the probabilities into 0s and 1s. So now if I want to know where a given particle is, I can quantify that by noting it in numbers that I can

47 Quantum systems can jump from one state of excitation to another. When energy is added to a system, a jump to a higher level of excitation occurs. In a downward jump, energy is emitted from the system. See also Chapter 2.

construct form 0s and 1s. So what I am measuring is qubits.[48] That is the way in which I think about a probability wave: it is a collection of lots of qubits that all tell me with a certain probability whether they are a 0 or a 1. So, when I locate the particle, I will have read out all those qubits. So, the language of probability waves is one we mostly apply to particles moving around in atoms, because there we are interested in their position.

Sarah: So really, Schrödinger was introducing visual imagery?

Erik: Yes, it was visual imagery, Schrödinger said so himself. He called it '*Anschaulichkeit*'.[49] He had issues with the language of Heisenberg and Bohr. It was Heisenberg who described it the way we do, in terms of states. He didn't consider the particle, he only thought about the states of the atom. It was an abstract way of looking at it, and it permitted him to describe state transitions. Bohr had taught him to do it that way. Schrödinger wanted to make it more visual and came up with the wave function. I have to say, I find it a bit frustrating. I find Heisenberg's solution more elegant, with states that transition. It's more abstract. Plus, I think the idea of the wave function has confused a lot of people. It's led to questions like 'but what is the wave made of?'

Sarah (*laughing*): That is one we have asked each other! It's fascinating that it is actually an irrelevant question, because it is only visual imagery.

Ton: But the fact that the wave collapses, the atom changes its state… What is it that causes that to happen?

Erik: Yes, those are wondrous aspects of quantum physics. And I have to say that I am really not sure that we have a good answer to that. It is true that in the way we use it, there is indeed a difference between what happens if you leave it alone or if you measure it… If you measure it, you get one answer and you have been handed the actualisation of a probability.

48 Qubits are quantum bits, the quantum mechanical analogue of bits. Rather than having a value of 0 or 1, qubits can be in superposition and therefore represent both values simultaneously.

49 German for graphicness. From the word *anschauen*, which means to view.

So the wave function and its collapse turn out to be a confusing description, a further example of how language can – inadvertently – steer us away from understanding. However, realising that brings us no closer to understanding how an observation can lead to a classical measurement, to reality taking shape.

The observer in the system

Henry Stapp goes a step beyond Erik's interpretation of how reality is formed out of quantum possibilities by reserving a role for a conscious observer.

Henry: According to Von Neumann's description of quantum mechanics,[50] there are two processes at work, and the first process has two parts. First a human observer poses the question: 'Will my experience be such and such?' The second part of Process 1 is what Dirac[51] called a choice on the part of 'nature'. So: we have the observer's choice of what question to ask – 'Will my experience be such and such?' – and then nature is given the job of answering the question.

Process 2 is merely the Schrödinger equation,[52] the present situation mathematically extrapolated in a classical mechanical way to what may come later. But then if you had only Process 2, you would just generate a bigger and bigger smear of possibilities. Because of the uncertainty principle[53] everything just smears

50 John Von Neumann was an influential mathematician who contributed significantly to early quantum physics.

51 Paul Dirac was one of the early contributors to quantum physics. He received the 1933 Nobel Prize in Physics together with Erwin Schrödinger.

52 The equation first formulated by Schrödinger that describes how a quantum system develops over time.

53 If one of two complimentary aspects of a quantum system is measured, there is a mathematical limit to the precision with which the other can be assessed. See Lexicon.

out. So in order to tie ontology to human experience where our choices make a difference, we have Process 1 as well.

Ton: So what actually happens, during actualisation, when reality is formed?[54] I used to think of it as: there is a probability wave and then there comes an instant of actualisation and then it is not a wave or a potentiality anymore, then it *is*.

Henry: No. What *is*, is never reduced to a point. It is only reduced to some segment of what came before. Say we have a box with a ball in it, with the lid closed. Originally, we don't know where the ball is in the box. So maybe it is uniformly distributed everywhere in the box. Then we ask the question: 'Is it on the right-hand part of the box?' We ask the question, and nature gets the job of answering the question. And it will answer yes or no. If the original knowledge was that the ball was equally distributed throughout the box the probability will be one half. So the original state represents probabilities.[55]

Probabilities for what, you may ask? Probabilities that the answer to any yes/no question that I might pose is determined[56]. So, the density matrix is this distribution of probabilities, of possibilities. You ask the question and nature is given the task of changing the world in such a way that it corresponds to the yes answer, or changing the world in such a way that it corresponds to the no answer. Nature is the big player in this game. And we have a little bit of a task in asking a question, but nature does the real work of changing the whole world.

Ton: What happens to the other probabilities?

Henry: They are eliminated.

Ton: What happens from the instant that the answer has been given? Because then it is still a probability isn't it?

Henry: But it is a new probability.

54 Actualisation is the term Henry has used in his books to refer to the probability wave collapsing, reality taking shape. See Lexicon.

55 Henry actually used the term 'potentiality' instead of 'probability'. Changed for consistency.

56 Akin to the 0/1 choice described by Erik.

Ton: A new probability?

Henry: Well, suppose the ball is originally uniformly distributed in the box and that's what we know, that is the probability. Then I ask the question: 'Is it in the right-hand part of the box?' And then nature is going to answer yes or no. If the answer is yes, the state of probability will be reduced and now it is equally distributed on the right-hand part but it has vanished from the left: there is no probability there anymore.

Ton: So it collapses into a new probability?

Henry: In orthodox quantum theory, it collapses into one branch or the other depending on whether the answer is yes or no. So, nature is the big gorilla in the room (*laughs*). According to this theory, if nature says the answer is yes, then it has the huge capacity to obliterate the other part. In this orthodox quantum view of reality, nature is an omnipotent god. It is in absolute charge.

So Henry describes how reality is formed through a two-step process, involving the interaction between an observer and nature. Sarah & Ton asked Erik whether there is such a thing as an objective reality, or whether we should take an observer into account. He said:

I think in physics very few people are currently willing to have reality depend on who views it. However, there are certainly circumstances where we need to take it into consideration, certainly in cosmology. It relates to what we call a horizon: it means that we can only observe a system up to a certain point. Black holes have a horizon, but so does cosmology, we can only observe the universe up until a distant edge. Beyond that, it is invisible to us. With a horizon, there are always two perspectives, one of somebody who stays on this side and one of somebody who dares to cross it. That leads to two realities that do not necessarily have to be described the same way. And that has to do with us tending to describe reality using language derived from an *interpretation* of what we see. So, I think that when we look at the cosmos, we describe reality in a language that may be different from the

language in which it is written. It means we are interpreting, translating, and that means we *have* to take the observer's perspective into account. These are discussions that we have long since had in quantum mechanics, with Schrödinger's cat, who is simultaneously dead and alive, and whether the moon is there when you don't look at it; that sort of thing. In physics, we usually interpret that sort of forming of reality as being due to decoherence. However, on balance I think we need to recognise that there is some sort of dependence on observation.

Ton: Because the observer is part of the system?

Erik: Well, the observer is part of the system, of course. But sometimes when you ask a question, you need to take into account *who* is asking the question. In physics, it is near forbidden to place man at the centre of the universe. It has been ever since Copernicus showed that the sun is at the centre of the solar system. In cosmology, we have gone so far as to include in the cosmological principle that every point in the cosmos is equivalent, meaning that the whole cosmos is homogeneous. I think that was a huge leap. We know from quantum mechanics that the observer affects what he observes. His choice of moment to measure, for example, determines what the outcome of the measurement is. Well, that is something that needs to be taken seriously within cosmology. We need to realise that we are the central observer, that is what our cosmological horizon is telling us: we are at the centre of our universe.

Slowly, we are gaining more ground to bring these sorts of ideas into physics, simply because problems are arising from *not* recognising these points.

Reality as a process

Both the physicists in these dialogues, Henry Stapp and Erik Verlinde, recognise that there is a problem with the classical view of a physical reality with no role for the observer. Sarah & Ton asked Alex for his take on reality. This is what he said:

Well, I am very attracted to David Bohm's ideas,[57] the implicate order and the holomovement, in which reality is a universal flux, mostly outside our awareness. I like the language of reality being a 'quantum sea'. It gives rise to a neutral monist[58] picture of reality where everything is spontaneously welling up and a 'quantum foam' develops where particles are formed.

Ton: Welling up because it is possible?

Alex: Yes, because it is just possible and it happens. And so particles are being created constantly out of nothing.

Ton: So, reality is merely a possibility?

Alex: Yes.

Sarah: An expression of possibility.

Alex: Yeah, I think so.

Ton: Why do you add 'expression'?

Sarah: Well, the image of 'foam' suggests that there is something happening there. It is not just the sea where it is calm and nothing is happening. The foam suggests that it is active.

Alex: Right.

Ton: So, what is happening, what is the action then?

Alex: I think some things are being created out of nothing. That is basically what is happening. And that is what quantum stuff is: something from nothing.

Ton: Something from possibility.

Alex: From possibility, right.

Ton: So, reality is a possibility?

Alex: Well, reality is the realisation of one of many possibilities.

Ton: Probably.

57 David Bohm was an influential theoretical physicist, who also worked in the areas of psychology and consciousness. He suggested that reality is a process, where there is continuous movement that precedes the formation of 'things' (and thoughts) that come out of and ultimately dissolve back into it. His ideas are most clearly described in his book *Wholeness and the implicate order*. The idea appears to have similarities with Erik's theory of information as the basis for reality.

58 The philosophical idea that the physical and psychological (i.e. consciousness) are two different expressions of the same underlying (neutral) reality.

Alex: Probably, right, yes (*laughter*). But, I very much believe that reality is open-ended, going forward.

When Sarah and Ton first discussed their ideas, Ton described his sense that reality is a process as follows: Reality has a direction in which it is going and you can sense there are all sorts of possibilities. I think that is the nature of reality: possibility. It is not a fixed and determined identity. I think reality is made up of possibilities.

I think that reality is a process, a process where possibilities interact with other possibilities. If those 'other possibilities' are by any chance a conscious human being, then together they actualise into reality. No, I should say: actualise into that human being's experience that she takes to be reality. So, there is a phase transition there, from possibilities into experience. That leads to new possibilities and so on. This process is constantly going on at all levels of nature. Reality is not exclusively a human process. But because humans have different possibilities from, say, plants or animals, they are likely to actualise different experiences.

Sarah: That resembles Henry's quantum physical take on reality a lot, doesn't it?

Ton: Yes. Quantum physics describes that there is not one objective material reality but rather probable states, possibilities. So, whenever we talk about matter and objects as the fundamental stuff of reality, we are thinking very classically. Quantum physics shows that things are not material *a priori*, not even an atom. It is like Heisenberg said:

'If one wants to give an accurate description of the elementary particle – and here the emphasis is on the word "accurate" – the only thing which can be written down is a probability function. […] It is a possibility, or a tendency, towards being.'[59]

59 In his 1962 book *Physics and Philosophy*.

An ‘observer’ can perform a ‘measurement’, which produces an experience. You know, like a scientist measuring some quality of something and the experience is one of ‘knowledge’. But this same process is going on in everyday life when you interact with the world around you. Your measurements will be more like sensing hunger and like feeling scared or happy. Or checking the balance on your bank account. Your observations are experiences. In quantum physics, the observer is a set of probabilities himself, just like everything else in this world. So, an observation is an interaction of possibilities with other possibilities and results merely in new possibilities. The experience in the observer’s mind is not definitive. It is at best a statement with a high probability. Such a view of reality is much more fluid, not as fixed and dualist as the classical paradigm.

Let’s face it, the above sounds far-fetched. For one thing, if reality is merely possibilities interacting with other possibilities, why is it not completely random? Why do we experience it as a continuous stream of events? Chapter 6 takes on this topic. First though, Chapter 5 addresses cause and effect, the classical way we view the connections between events.

5 When efficient causation breaks down… Synchronicity and meaning

In the previous chapter, we saw that rather than thinking about reality as a static state, it may be helpful to think of it as a process, and perhaps even a process in which the observer participates: she has an active role in determining what is observed. This is certainly true in quantum physics, where quantum superposition is not resolved until a measurement is made. Our classical way of viewing the world leads us to interpret it as being much more absolute at the (larger) scale at which we live our lives. But, as we saw in Chapter 4, quantum processes play much more of a role in our daily lives than we typically realise. For example, entanglement, where two quantum systems interact immediately irrespective of their distance, is a central concept in quantum physics. Yet it appears to defy causality, as we are used to defining it (where one event causing another must always precede it). Erik Verlinde said the following about quantum entanglement:

Because of entanglement, teleportation like on Star Trek – you know, where you simply request to be beamed up – is actually impossible. Physicists used to think that if you took a bunch of molecules apart and reassembled them in exactly the same way you should be able to recreate the person. But that isn't the case: even if you recreate it all, take all the molecules and particles that you are built up of, and put them back in exactly the same place, you will have forgotten how all those particles were entangled. You would have to recreate that as well, including the whole system you are part of.[60]

60 Erik actually credited his twin brother, physicist Herman Verlinde, with this idea. This was left out for brevity.

Erik was talking about us being physically entangled with our physical environment. However, perhaps there are other forms of entanglement we are subject to without realising it. We have all had the experience of meaningful coincidences, when our intention or feelings seem to align with the outer world. Herman Wijffels and Herma van der Weide described their experiences talking to their son who lives in New-Zealand:

Synchronicity in our daily lives

Herman: It happens to me regularly that I think 'I should call our son, Pieter…'

Herma: And then Pieter calls!

Herman: And then Pieter calls. And that hasn't just happened once or twice you know…. It happens to me all the time.

And of course, Pieter is our son. But it happens to me too with people I only see once or twice a year. I think I should give them a call, and lo and behold!

In our classical way of viewing the world, the only link between events we take seriously is a causal one, where one event (through the exertion of a physical force) causes another. For example, (to adhere to the atomic framework) when a cue hits a billiard ball and causes it to go skidding across the billiards table, only to collide with another ball and send that off on its own trajectory. We call this type of causal connection 'efficient causation'. However, if in reality we are entangled with our environments, does that not permit instantaneous connections that are more than mere coincidences? This kind of instantaneous, meaningful connection is known as synchronicity. Whether it is in fact a quantum (or even real) phenomenon is an open question in science.

Herma said: Synchronicity is a nice example really. If it happens to you a lot, you realise that there is no way that it can merely be coincidental. There is some sort of sensing going on.

Herman: And it's one of those things where you can ask yourself: Do I notice it because I am aware the phenomenon exists? Or does it occur more often because of all I have done in my life to become more open?

Herma: You could even wonder if you are causing it to happen. There are examples, in particular from wilderness experiences: Joe Jaworski describes an experience in his book,[61] where he had been in the wild for several days and nothing had happened. And as he was reflecting on the lack of action, two whales jumped out of the water! At exactly that moment! It seemed to be his state of mind that caused it.

Herman: I t happened to me in Africa, where we were with a group of seven or eight people, with two guides. We were trekking through the wilderness and one of the guides said to me: 'Do you see those two buffalo? They have been tracking us for a couple of days, in parallel several hundred meters away.' I hadn't seen them, but he had spotted them. The point I want to make is that I have the sense – there is nothing scientific about it, it's merely my sense – that for us to be able to be open to the kind of information we need for the next stage, we have to open ourselves to it. It's what you call becoming 'porous', Herma.[62] We have to become porous. There is nothing rational about getting that information, it has to come through intuitive channels. That's my experience, anyway.

Sarah: I find too that when I have many synchronistic experiences, it's a sign that I am well connected. Something happens, I am 'in sync'. And if it decreases again, it's a sign to myself that I need to do something, that I am not connected anymore.

Herman: Our experience is that meditation really helps to stay aligned. That is also what Joe Jaworski talks about in his book, being open to the information that is out there.

61 Joseph Jaworski wrote the book *Synchronicity* about how he came to notice and use synchronous events in his own life.

62 A term borrowed from Canadian philosopher Charles Taylor, who describes people as porous who perceive themselves to be part of a larger whole of meaning. Buffered selves, in contrast, perceive themselves as being separate from their surroundings.

Synchronicity in quantum mechanics

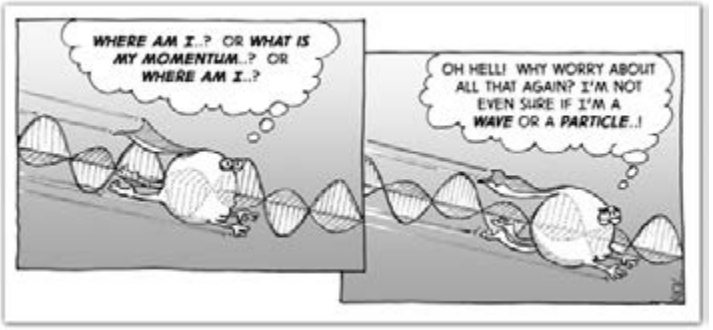
Henry Stapp explained what synchronicity means in quantum terms:

Synchronicity is the transfer of information instantaneously, or at least faster than light. It relates to when you have two different regions and you are doing experiments in both regions on two particles that come from a common source, for example. The question is whether the outcome of the experiment over there can be influenced by what the observer chooses to do over here.

Ton: By which question he asks…

Henry: By which question he asks. I just want to emphasise that the problem is not with the correlation you find. For example, if you have two balls, a black ball and white ball, and you look in those two regions: if you find a black ball here, you will know that there is a white ball over there. What you find in one place is correlated with what you find in the other place. However, these two balls also have temperature. They are not only coloured but one of them is heated. Now suppose for some reason you can't ask both questions simultaneously; what colour is it and what temperature is it?[63] So, the issue is whether what is observed over there can depend on which question you ask over here. It certainly seems reasonable to expect that what question you decide to ask at the last minute over here should not affect what is observed over there in any way. But the fact is that you cannot maintain that condition of non-dependence. It turns out that what nature chooses over there is not independent of what the observer chooses to measure over here. So that is the instantaneous action at a distance that we talk about in quantum mechanics.

63 Quantum systems have pairs of properties that cannot be measured simultaneously, such as wave properties and particle properties, or position and momentum. This phenomenon is known as complementarity. See Lexicon.



During the meeting with Erik, as Sarah was broaching the subject of synchronicity, he raised his arms to illustrate a point. As he brought them down, the sunshade outside the window automatically began to lower itself. He joked: Yes, that was me…

Sarah (*laughing*): There you go!

But really, what do you think about phenomena like that, when you want to call someone, you pick up the phone, and that person is on the other end?

Erik: You mean, like telepathy? I have already said that we are physically entangled with our environment. We are part of the space we inhabit. But also our memory, everything that has happened to us, affects how we are entangled with our environment in a quantum-mechanical sense. So, we people – and that includes our consciousness – are much more than just a bunch of molecules that happen to be stuck together. You have to take the environment and our entanglement with it into account. And if you do that, then you can imagine that there just might be links between you and what is happening elsewhere.

Ton: Are you aware of the correspondence between Pauli and Jung, the psychoanalyst?[64] They tried to translate synchronicity and entanglement to the level of our everyday lives, to recognise non-classical, non-causal connections. They tried to use non-causal connections to explain meaning, and intuition…

Sarah: … phenomena like when you just dropped your arms and the sunscreen came down, whether that might be entanglement.

Erik: Well, I do think we need to consider entanglement in thinking about our reality, in the sense that I am not completely independent of my surroundings… It's hard to imagine how you would apply it in daily life. But yes, I do believe our world is more quantum mechanical than we realise…

Sarah: What I found charming about what Pauli and Jung tried to do, is that they attempted to concoct a complete 'theory of everything' that included all aspects of reality, not only the ones traditionally subject to science. In physics too, you said about quantum mechanics that really you can only study it from the point when you measure it. Before that point in time, when measuring it changes the system, you can theorise about what it means to have a vacuum with entangled information, but you can't do anything with it, because you can't touch it.

Erik: Perhaps not, but the beauty is that you can calculate the consequences. I compare it to the atomic hypothesis in the nineteenth century. That was a hypothesis that couldn't be tested by measurement at the time, but it led to the derivation of the laws of thermodynamics and all sorts of other consequences. You don't have to measure it directly, but there may well be measurable consequences that you can measure at another scale. Einstein first tested the atomic theory by studying the Brownian motion

64 Carl Gustav Jung, the founder of Jungian psychotherapy, and Wolfgang Pauli, one of the founding fathers of quantum mechanics (Nobel prize 1945), corresponded about the nature of reality, trying to link the physical and 'psychical' domains. Their correspondence is published as a book entitled *Atom and Archetype*. See References & further reading.

of large molecules in a liquid. You can't see the little molecules of the liquid but they bang into the large molecules that move in response. He proved the existence of the small molecules by measuring their impact on the larger ones.

Are our synchronous experiences quantum?

We all have had synchronous experiences, but whether or not they are related to quantum processes remains an open question. One that is hard to investigate, but not necessarily impossible, as Erik pointed out above. Ton asked Henry whether he sees any evidence for quantum effects at the human level. He said the following:

There have been claims that what an observer at a certain place is witnessing can be communicated to another person located far away. Distant-viewing experiments have certainly been reported and, supposedly, the US government spent a lot of money during the Second World War trying to get information by distant viewings like this. Some of these distant viewers were supposedly able to go to certain places and look into highly secret places and report what they saw. I do not feel qualified to say whether these reports are true or false, but I would say it is conceivable that they are true.

In discussing the same topic with Ton, Sarah said: What I find complicated about the difference between causality and synchronicity is that it seems to be entirely dependent on the phenomenon of time. The only thing that distinguishes a causal connection from a synchronous connection is its timing. And if you think about that from the perspective of general relativity and spacetime, which tells us that time viewed from a different perspective could just as easily be space, it suggests that the only difference might be that you are slicing the quantum probability wave from a different angle.

We think extremely causally in our daily existence. However, there are three different potential ways that events can be connected: Identity, causality and synchronicity. In identity, one

thing *is* another, the way Clark Kent is superman. That is most obvious if they inhabit the same location in space and time. Perhaps that is what is happening in the case of a physical body and consciousness: they are actually the same thing but in this cut through the probability wave they happen to look like an independent body and an independent mind. If that is true, saying the body or brain somehow causes consciousness is inaccurate.

Causality, we are overly familiar with. Its most important rule is that the cause should take place before the consequence in time. It is therefore completely dependent on time. But if you were to change the way in which you slice spacetime, it could be that cause and consequence will coincide in time and then suddenly they would be synchronous. So really, it is an open question whether those three things, identity, causality, synchronicity are different at all, or whether they are just different manifestations of the same connection and their form depends on the way we slice the multidimensional probability wave.[65]

Meaning and synchronicity in life

We have all had the experience of synchronous events, and interestingly they are often related to things to which we attribute meaning. But what really is this meaning? In an atomistic reality held together by merely cause-and-effect relationships, there does not seem to be a place for it. Is the weird world of quantum mechanics any different? Does it provide a mechanism to attribute meaning to our lives? Ton talked about one of his own experiences:

65 There is a long tradition of thinking about causation in philosophy going back to Aristotle. He recognised four different types of causes: material (the material something is made of), formal (the structure or design), efficient (the force that brings something into being) and final (its purpose). For a table, the material cause might be wood, the formal cause its design, the efficient cause the carpenter and the final cause the enjoying of a meal at it.

I see a link between synchronicity and meaning, the fact that they both transcend time but seem linked to one another. It happened to me recently: we had just moved house and I was standing in our back garden, looking around, trying to orient myself and my next-door neighbour came out the back door of his house. As I saw him approaching, I thought: 'his mother has died.' Then he walks up to me, and begins to tell me that his mother has just died. Everybody has smaller and larger experiences like this. And it doesn't sound like a lot, but it was meaningful to me. It was my connection to the man.

As a psychotherapist, Ton works with people who are struggling with meaning in their lives. He said:

Emotions and thoughts contain possibilities to evolve into other forms, into other possibilities. For example, when you feel angry and act accordingly by slamming a door and that scares someone else, and so forth. The anger was converted into physical behaviour and material consequences that contained different, new possibilities. So, in that sense, emotions are similar to matter.

Sarah: When you put it like that, it sounds a lot less disputable than saying 'an emotion is like a table'. It sounds more like bridging the fissure between mind and matter.

Ton: I am saying that emotions and thoughts are immaterial but if you look at them from a distance they share characteristics of material objects. What determines the form is the experience. Matter and mind are not so different. It is more of the same but in a different form, a different form but with the same at the core of it: possibilities.

In talking to Alex Wendt:

Ton: I think there is no exact border between something being matter and something being a concept or an experience. It is a package, rather than 'just matter being experienced'. It is all part

of the same reality, and therefore experiences and concepts can also have mass. Let me explain:

I think of it as reification, from Latin: '*res*' means 'thing', a material thing. If reality is truly built up out of information, then things that have mass come from information. Information can actualise into things that have mass. So, if anything is information, then anything can in principle have mass too. Meaning can have mass and weight, just like waves of light can. It probably doesn't weigh very much, just like a beam of light weighs almost nothing. But almost nothing is not nothing.

Alex: Well, that is true, that is true. I thought you were going to say that reification is a good thing because it helps us stabilise the social world. So if we reify the state, that helps stabilise everyone's expectations, keeps the wave function under control so to speak, and reification becomes really important for continuity. But I had not thought of linking it to matter.

Ton: By using 'reification' I mean to say that something that is a concept or a thought is really there.

Alex: Yes, that is what I would guess. I would say: it is really there because people think it is there. The state is not anywhere really, except in people's minds. That has a physical weight dimension in the sense that people have mass. And in what the people do I guess, their behaviour, right?

Ton: It needs the material aspect of the people to be there too. So, it is a whole, it is a package of the material and the conceptual stuff together.

Ton is saying that possibilities do not merely seem to 'collapse' into a physical reality, but also into the more experiential aspects of it, including meaning and consciousness. Henry said something similar in explaining that it takes more than the Schrödinger equation to translate possibilities to a classical experience.

Henry: Quantum mechanics was originally designed to cope with the problems of atomic particles and tiny little objects. The

way it is described by Von Neumann is that we human beings have a major role to play in the unfolding of reality. In a word or two: it turns out that the Schrödinger equation is not sufficient to describe nature. The Schrödinger equation creates a description of the world that does not match our experiences. We do not experience a smeared-out world, as it predicts. If you build a device designed to magnify microscopic properties into macroscopic properties, the position of a pointer on a dial for example, the Schrödinger equation says that the pointer will be smeared out over the entire dial. But we human beings find the pointer at a fairly well-defined position. So, you have to understand that this transition from the smeared-out description that is created by the Schrödinger equation somehow has to be reduced to our experience of a well-described classical reality.

So the basic problem is: how does this happen? The answer is that the observer poses a question to nature. For example: will my upcoming experience be the experience of seeing the pointer move to the right? So that is a yes/no question: will I see it moving to the right? And then something we call nature – or that Dirac called nature – makes a choice and actualises: Is it a yes-answer – do I see the pointer moving to the right, or is it a no-answer in which case you don't see the pointer moving to the right.

It puts the human observer into a position of making choices that allow her to be a causal input in the evolution of the world. That is in contrast to the view of Newtonian, classical mechanics that preceded it: classical mechanics says that the human being is just a mechanical robot in some sense and that her every action was determined at the birth of the universe. What she presently observes is just a mechanical evolution of the initial conditions of the universe. In contrast, quantum mechanics is a very understandable, dynamic and mathematically rigorous description of how the universe could work and it allows us to have a meaningful life. Whereas according to classical mechanics life is meaningless.

So, quantum mechanics, although originally intended to merely provide an understanding of atomic phenomena, actually

turns out to be far more than that, namely a description of how we human beings operate, and how we fit into the world. It permits our lives to be meaningful, because it provides a mechanism by means of which human values can be injected into the world…

6 The direction of change

Chapter 4 explored the idea that reality may be an interactive process leading to the stage of time and space rather than set on it, and – perhaps more speculatively – that there may be a role for us as observers in the process of causing reality to unfold. The last chapter investigated synchronicity and noted that there is an apparent overlap between phenomena, such as quantum entanglement and our experience of meaningful coincidences. Now Chapter 6 picks up the thread from Chapter 4 and asks why, if reality is a process, it does not appear random. What is the mechanism by which it appears stable to us, as a continuous stream of events?

Reality as a stable process

Sarah asked Alex Wendt how reality may be kept in place: So, if I visualise this: less than having a probability wave collapsing into a single point, it seems more like it is 'touching upon' the wave that results in an experience. The Zeno-effect may be a mechanism to keep that experience in place, as long as you continue to touch upon the wave by making your observation.[66]

Alex: I know Henry Stapp has written on this a fair bit. My understanding of the Zeno-effect is that if you keep making the same measurement you will keep getting the same result. So it is not probabilistic any more. I have thought about how that translates to social science. In the social context that might be manifested in institutions, such as the governance of a state through the separation and balance of legislator, judiciary and executive powers. Or an institution like marriage: if people keep

66 The Zeno-effect is the quantum property that once an observation has been made and reality has taken a certain form, this form is maintained and carried forward as long as the observer continues to observe. See Lexicon.

getting married, in a sense those are constant measurements, Zeno-effects. That is what keeps the institution basically stable and alive. So in that sense the Zeno-effect is very interesting to me.

But I like what you just said, your image of the wave function sort of getting 'touched'. The external world is touching it basically, producing a kind of conscious 'flashes'.

Sarah: If it is a 'touching upon' the wave, it doesn't have to make the whole thing collapse. Because if you make the whole thing collapse, it sounds as if it then disappears. And that makes absolutely no sense to me.

Alex: Right, that is right. You have the collapse and then it just stops. There is no story about how it gets put back together for the next observation to take place.

They returned to it later in the conversation, in relation to Ton's point about reification.

Sarah: Reification sounds to me like it is a way to help us keeping Zeno-effects stable.

Alex: Yes. That is exactly what I wanted to say: reification and the Zeno-effect are conjoint.

Sarah: In that sense, mass is only one possible expression of information. If you express, or 'reify' information into objects or meaning or consciousness and then keep them in place, it is a Zeno-effect. A way of keeping reality stable.

Directionality in reality

So, the suggestion is that it may be another phenomenon from quantum mechanics that is keeping reality stable, the so-called Zeno-effect. The Zeno-effect is the phenomenon that once an observation has been made and reality has taken a certain form, this form is maintained and carried forward as long as observations continue to be made in fast enough succession. But it does not explain why reality has evolved to be as complex as it

appears to us. Erik Verlinde explained that from his perspective, reality increasing in complexity is inevitable, a side effect of the way reality is structured.

Erik: People often mistake information for meaning.[67] They think information is something that must be useful. You know, like the intelligence spies collect: they are expected to provide useful information that can be used to track the movements of enemy governments, and the like. Also, people tend to assume that you don't know anything about information you don't have.

In physics we have a more absolute idea of what information is. When I think about all the molecules in this room, I really don't want to know what each individual one is doing but I can still provide a measure of how much information I would need to describe them. That is what information is to us: a measure of the amount of information. Even if that information is not useful to me and I don't use it, I can still give it a number. So, the sort of information we think about in relation to black holes or the way we calculate gravity in my latest paper is information that is present in the space itself. It is not useful in and of itself, but we can measure it. So, a room with more particles in it has more information than a room with fewer particles. But it is a different sort of information than you will find in the newspaper, for instance.

Sarah: The way you are talking about it reminds me of something Ton and I have talked about a lot: if you have maximum entropy, in a certain sense you have maximal possibilities, because nothing has yet taken shape. As the entropy decreases, like when information takes on shape, you have fewer possibilities but greater complexity…

Erik: That's right. It relates to what I think about how we have structures and things in the universe… Luckily, we don't have a maximally entropic situation. So, for example, one of the things

67 Another example of language sometimes confusing matters more than clarifying them.

I calculate is that when there is a mass in a specific location, rather than distributed evenly over space, it has less information than when…

Sarah: So the information is decreasing?

Erik: It decreases. Structure arises because of complexity… you have entropy decreasing, but indeed you do get complexity in its place.

Sarah: So, would I be right in saying that there is a counterpart to the entropic force in nature, and that it is for nature to organise itself. Is that fair?

Erik: Yes, I think that is fair. I think it is inevitable in a system with a great number of degrees of freedom. It always leads to some form of organisation.

Ultimately, I think it's the Gaussian distribution. If you have lots of something, most of it will be in the centre of the distribution, and there will be nothing to see. But what is in the tail of the distribution is lots of wondrous stuff that looks nothing like equilibrium. And the universe is so complex, that all sorts of things arise. Most of it is not interesting, but the things that are interesting are in the tail of the distribution. That is why I think in physics, we have only focused on the things in the tail. We see less than 1% of the universe. Our world is constructed of the things we find interesting, but most of it we don't find interesting and we ignore. We have dark energy in the universe, that is more than 70% of what there is, and we do nothing with it! 70% of the energy, and we ignore it, it's not interesting to us. But that is where most of the entropy is.

I think chaotic systems often give rise to self-reproducing patterns, related to the fact that when certain things grow, other things become smaller. So, when you consider space, and all its possibilities, there are areas you are attracted to. In a chaotic system, you get these nooks where things can reproduce and continue. One example is turbulence in a liquid: moving liquid will stream evenly until it gets caught in a corner, and then you see all sorts of things happening. What you always get in the corners of a system with liquid flowing is swirls – you've seen

them, like water running down a drain – and those patterns are very interesting to look at. Then when I consider weather patterns, which is actually a very similar system, you see these same sorts of swirls in weather systems. And when you consider the red spot on Jupiter, it is actually a self-perpetuating storm that has been there for millions of years. And then, when I put pictures of our galaxy next to those… they are very similar.

But those storms only arise because of everything that is going on around them! You don't see that part, that airflow is invisible in weather photographs, but it somehow produces the storm. I think the same thing is happening in space. We only see the galaxies, but around them there is this huge system that we don't pay attention to, that we don't see.

Ton: That is so interesting! You are talking about matter, but I see the same thing with my clients. They only see the storms that are going on, and not all the stuff around them.

Sarah & Ton discussed the possibility that the direction in which reality unfolds may not be random with Alex too. He said the following:

If the natural social metaphor for the classical world view is that the state of nature is atomistic, mechanical, then we are all completely separable. In a quantum world, we are not completely separable, so it makes much more sense to think of it as having a formative tendency.[68] Because it is a single thing.

Ton: There is also the very down-to-earth argument that if nature did not have a formative, teleological[69] tendency then nothing would ever exist for at least a while. Because everything would be entropic or random or nothing.

68 Term borrowed from Carl Rogers. See also note 36 and Lexicon.

69 This text follows Thomas Nagel's assertion that teleology means an inherent tendency towards greater complexity, but does not necessarily require a 'creator' or other outside force to assert this tendency.

Alex: That goes back to the quantum coherence[70] idea, because that is what resists entropy basically. In my view, that is the basis of life. Have you come across the phrase 'directed mutation'? There are quantum biologists who are saying in natural selection the mutations are not random.[71] They are directed. Again, that is an example of a formative tendency. They argue that all organisms are constantly trying to adapt their forms purposively to deal with disruptive pressures in the environment. And it is funny, even in the quantum physics case, they always say that what is going on in the particle chamber is all random. Well, not necessarily. It looks random from the outside but from the inside, but maybe, if it is a panpsychic world, it is not random at all.

Ton: It is probabilistic but with a bias towards forming something.

Alex: That is the way to put it yes. I do think that nature has an ordering tendency. One of the big problems in biology for instance is that proteins can take on zillions of shapes, so how do they end up in the particular shapes that they do? Computationally it is completely intractable. Nobody has any clue. But quantum people are coming along and saying 'Actually, we can explain this!'

Ton: There comes a point when a teleological explanation is much simpler and becomes preferable.

Alex: Yes. I think the anti-teleology of the modern world is really a legacy of this classical mechanistic Newtonian framework that excludes it. So, if you go back to a more organicist picture of the world, teleological reasoning is much more plausible.

Sarah: In talking about how reality is formed, I really like the image of the 'foam' on the 'ocean' of possibilities where actualisation takes place.[72] But what I miss in that description is the

70 Quantum coherence is the phenomenon that if the waves describing a quantum system are in phase, this allows the system to remain in superposition.

71 See the book mentioned earlier by Jim Al-Khalili and Joe McFadden, *Life on the Edge*, where they discuss this idea.

72 Refers to the discussion on David Bohm's work in Chapter 4.

notion of a formative tendency. Things are not popping in and out randomly. It has directionality. There is pattern formation, like strings weaving together, which gives direction to it.

Alex: Yes. Some people argue that the purpose of evolution is to increase freedom – in general – by creating more complex organisms that have more free choice, more free will. Whitehead said that nature is about increasing freedom.[73] I find that a very attractive view.

Sarah: Freedom for the organism. The possibilities for the organism grow while cutting down the entropic possibilities in the 'ocean' that surrounds it. That means the external probability goes down, so there is a balance.

Ton linked the tendency of reality to unfold in a certain direction to meaning. He said: I think reality possesses a tendency to not remain the same, but instead to form itself, to gain meaning, to become more complex, to create a more complex whole. I think that is what we usually call 'meaning'.

Sarah: Are you saying that meaning is in fact the development of direction and choice?

Ton: Direction? Perhaps, less randomness anyway. I think of this formative process as a 'funnel' where possibilities bundle up. First there is this state of maximum possibilities in chaos, entropy. From there on, possibilities bundle together to form a concentrate, a rock or a person, for example, or an emotion. In the case of a person I mean the whole package that comes with it, inner experiences and material body.

Sarah: The image of the funnel triggered my memory of an image that my 13-year old nephew brought up once. He was writing about his family for a school project he had at the time. His family history is pretty complex. His father is from Africa and

73 Alfred North Whitehead was the founder of process philosophy, the idea that reality is a series of events (occasions), where objects are merely events that are stable over time. It was an attempt to get away from Cartesian dualism and his ideas have overlap with the concepts discussed in this book.

his mother from Europe. He found out that one of his ancestors killed relatives of the other, so that was very complicated for him. But he created a wonderful image of his family tree with lines that converged in him as a person and then diffused into the future, like a funnel.

Ton: Beautiful. I think the accumulation of possibilities that develops, in part due to your own choices, is the meaning that you give to your life. Meaning includes your past experiences and is a source of future possibilities. I think the word meaning could be taken to describe any accumulation of possibilities. So, when two atoms combine into a molecule and thereby create new possibilities, that is just as much a form of meaning as when an emotion and a thought combine into behaviour. In both cases, possibilities accumulate.

This process does not necessarily run in a gradual, linear manner. Nature is full of examples of how entropy is sometimes stronger and fuels the process and it leads to more significance than would have been possible before. For example, a forest fire is often a necessary step in the rejuvenating process for the forest as a whole. Similarly, in human development, allowing some chaos may be a way to get rid of a habit or an emotion that has become a dead-end street. In such cases, a sudden increase of entropy provides a source of possibilities from which, if we manage to stay sufficiently composed during the process, we can start anew. What seems to matter, is a healthy balance between entropy and the formative tendency. So, if handled well, entropy may indirectly contribute to more meaning.

Henry Stapp noted that the direction of change in reality seems not only to be towards more complexity, but even towards a better experience for the observer, whether or not by design.

Henry: The question is *why* does nature choose to answer a question with yes and not no? At this point, I deviate from Von Neumann's orthodox theory. According to Von Neumann, nature's choice is random. There is no reason why nature chooses

one option above the other. Einstein said: 'God does not play dice', but according to strict quantum mechanics, God *does* play dice with the universe. However, I am with Einstein in believing that God does not act without a reason. In other words, I adopt the principle of sufficient reason, that nature has a reason to choose one outcome above the other. It allows you to understand otherwise inexplicable phenomena, these acts at a distance, instantaneous actions, entanglement, some of the more unorthodox aspects of quantum mechanics.

Nature is in the driver's seat and has to choose one outcome or the other. It has to choose between you are going to have this or that experience. So, it is *nature* making the choice. Nature itself – just like us – has its values and they happen to be in favour of the human experience being positive. But that may be just one way of looking at it. Alternatively, the fact that an experience is positive and pleasurable has to do with something else, some structure that nature is actually aiming for. Nature's aim may actually be a more abstract form that happens to often correspond to increased pleasure versus pain. So, I haven't worked any of this out in detail, but I am saying that it is not just random. There is something entering into nature's choice and that means God is not playing dice with the universe – or that he is playing with loaded dice. That might be a better way of putting it.

Ton: So, your message is that there is directionality in nature, and that nature is choosing in favour of us…

Henry: What I said was that there seems to be empirical evidence that nature is responding to you in ways that are intrinsically positive. Nature wants to be beneficial. From the point of view of quantum mechanics there seems to be this idea that there is an input into your life from something like a cosmic force because an observer is required for reality to form. And it seems like this cosmic input wants your life to be happy, pleasant and that you don't have to fight this alone, nature is on your side. I think many religious people gain comfort just from the belief that God is somehow trying to help you out and it is a beneficial thing, not something negative.

Ton: What about entropy in nature? You are describing a positive tendency, but obviously there is also a destructive counter-force. How do you view that?

Henry: Well entropy has to do with the amount of structure. Entropy is just a matter of how random it is, or how structured it is. The degree of deviation from randomness. It is a tendency on the part of nature to make things less and less structured. Everything gets washed out and structure disappears. Whereas what we have been talking about before, would be a tendency of nature that countervails the law of entropy. A tendency that is adding more and more structure.

I am not saying that or suggesting that nature's choice is designed to necessarily oppose entropy, but I am saying that that is the effect of it. Because the random choice will tend to make it less and less structured. Because if something is equally possible to be this or that, and then the actualisation follows that law, then you will have a general destructuring tendency (*laughs*). But if there is something trying to make people happy… well, happiness has more structure than randomness…

Herman Wijffels noted that the tendency towards ever-increasing complexity means we are entering a new phase of global awareness.

Herman: I feel that in this era, we are dealing with global awareness for the first time in history. It has been strongly facilitated by technology. The Internet and the media that are connected by it form the infrastructure for this global awareness. It means that there are many more manifestations of connection than before. For example, you could say that the refugee crisis is a direct consequence of it…

Ton: How?

Herman: Well, people in Africa, living in relative poverty compared to us, have mobile phones too. They know what it is like here. So they think, why should I stay where I am? They trek to Europe, thinking they will fit in one way or another. It

is a whole new phase in our evolution, including economically: the globalisation of the economy is a result of global awareness. It makes perfect sense: if you are a businessman and they can produce your products more cheaply in China, you have them made in China. It's good for the Chinese too, because it brings some of the Western wealth their way.

Sarah: We talked about a greater awareness that we are all part of, but also about individual consciousness, our having a sense of self. Are you saying we need to depart from that sense of individuality, the sense of 'I' and instead move more towards a sense of collective consciousness? Of 'us as a society' or even 'the world'?

Herman: Yes, that is exactly what I am saying. As far as I am concerned, that change in our perception is a condition for the survival of our species. I think we have come to a stage in the evolution of life on this planet, and of our human evolution, where we can only survive if we operate and work and view life from collectiveness. That is where we are.

It translates into individual consciousness in two ways: the first is, you need to be aware of it. The second is that the question being asked of every one of us is: what is *my* contribution to this process? How do my possibilities, my talents, my process of actualisation contribute to this transition? That is the stage we are at.

Sarah: Individual development as a societal responsibility.

Herman: Of course! Just look at it historically: the developments in the industrial era led us to emancipation. Emancipation is one of the most important results of the industrial age. But what *is* emancipation? It is a higher level of awareness of your own individuality. You become more aware that you are an individual. To some people that is still the goal of their personal development. However, the next logical step is that you connect to the whole from your own individuality. That you contribute to the functioning of the whole. That is where we are now. What is necessary is to broaden our consciousness. Rilke put it beautifully when he said: '*Ich lebe mein Leben in wachsenden Ringen*';

I live my life in ever-widening circles.[74] That is what we need to do now.

Awareness as an inherent feature of reality

Above, Herman talks about our responsibility to contribute to the process of increasing complexity in reality. But clearly, we are part of that reality. What is our consciousness and how does it relate to this complexity? As noted in Chapter 2, consciousness is one of the phenomena that our atomistic, deterministic paradigm has not yet been able to explain. In the conversations included in this book, many of us leaned towards a more panpsychic outlook, the idea that awareness may be an inherent aspect of reality. There is also the question whether conscious observation is necessary in quantum physics, and of whether these two issues are related in any way. In talking to Alex:

Ton: On the one hand your book has a very panpsychic feel to it and on the other hand in some places you say things that seem dualistic, like: a rock has no consciousness, only systems with quantum coherence have consciousness. What do you really think?

Alex: While I was writing that chapter, I was very aware of the fact that the sceptics are all going to say: 'So you are saying rocks are conscious?' I did not want to go that far. I want to say rocks are not conscious, even though some philosophers believe they are. So, I wanted to have a more traditional view, in which anything that is inanimate, not alive, cannot be conscious. Anything that is alive is conscious. That is how I would divide it. Really it is a very traditional approach.

74 Rainer Rilke was a German-language poet. His poem *Ich lebe mein Leben in Wachsenden Ringen* was included his 1899 collection of poems *Das Stundenbuch* (The Book of Hours).

Ton: But then we don't have a very clear definition of what life is.

Alex: Well, we do now. I believe quantum coherence is a necessary condition for life. Consciousness is inherent to life. Consciousness is based on quantum coherence, life is based on quantum coherence. Rocks do not exhibit quantum coherence so they cannot be conscious. And so each individual particle inside a rock is going to do its own thing, collapsing or whatever, the rock's stability is held together by other forces, classical forces I guess. But not quantum forces, because it is not alive and so doesn't have coherence.

Ton: Okay, you are advocating limited panpsychism then.

Alex: It is limited in the sense that I am saying that not all macroscopic objects are conscious. At the microscopic level, awareness[75] is pervasive, or at least there is potential for it to be. But then you get this split between living things that maintain quantum coherence and have some sort of consciousness, and the non-living things that don't.

Sarah: In your book there is this image of an atom coming into and out of existence which does imply some level of awareness, however limited. Why would that not translate to the level of the rock of which these atoms are a part?

Alex: That is a good question. My gut instinct is that the experiences that atoms are having of their universe are fleeting. They just disappear.

Sarah: Come in, come out.

Alex: They come in, come out, it is a constant flux. But because there is no coherence structure around those atoms their experiences are not preserved in memory and do not lead to a sense of self.

Sarah: That description of quantum coherence makes it sound equivalent to the Zeno-effect. So as long as you have this coherence you can keep on making the same observation which

75 Alex used the term 'consciousness' in the context of awareness. Changed for consistency.

translates into something like memory which enables a sense of self that is continuous over time.

Alex: So, the Zeno-effect is crucial for the consolidation and maintenance of…

Sarah: … a sense of self…

Alex: … a sense of self. That is really interesting.

Sarah: So, within a rock there are little flashes of awareness all the time that don't map out into a longer pervasive sense of consciousness over time.

Alex: Right, that is the idea, right. Yes.

Sarah: I think that what happens when you touch the probability wave is 'dual aspect':[76] the material aspect is that an atom appears, a flash of awareness is the other aspect. They are two aspects of the same experience. But you need the Zeno-effect to have a continuous sense of awareness and that is what atoms lack.

Ton: So 'Zeno-ing' is also a continuum, you can have a very small Zeno and a very big Zeno?

Sarah: Well, atoms I guess have Zeno for as long as they are atoms and then they flash out of existence.

Ton: So, they are Zeno-ing in short bursts? Compared to humans for instance?

Sarah: Compared to humans, yes. So an atom goes 'bloop!' and that was a Zeno, and our Zeno spans 80 years or more on a good day.

The nature of individual consciousness

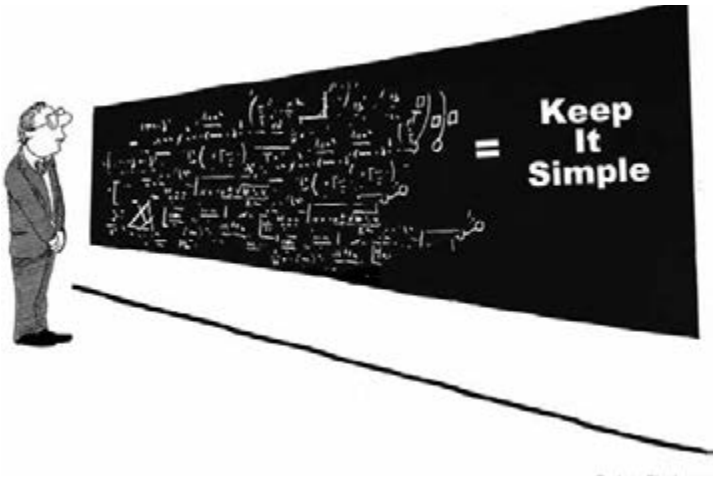
But if our individual consciousness is based on our individual string of observations, and it is this continuous string of observations that gives rise to our sense of an outer world, as well as our sense of self, then how do we interact with each other? It only makes sense if our individual consciousness is part of a

76 Relates to neutral monism that is sometimes also called Dual Aspect Theory.

greater consciousness, perhaps the more global awareness we talked about with Herman and Herma. In talking to Erik, Sarah put it like this:

When I started thinking about consciousness, one of the first things I did was to write a paper about the relationship between it and the brain. One of the conclusions I came to is that what our brain and senses do is to filter. We can only detect a limited spectrum of electromagnetic radiation (visible light), a limited range of sound waves, and the same argument can be made for all our senses. The information from our senses is then brought together in our brain. Then when you look in the brain there are all sorts of mechanisms in place to limit the amount of information that is carried forward. That brought me to my hypothesis that it might be the goal of brain function to *create* a limited consciousness, a sense of self as unique from the surroundings, thereby enabling us to interact with a complex and rapidly changing environment.

Erik: I think that is a wonderful way of describing it, and it relates to what I was saying about some information being important while some isn't. In deciding what is important you somehow create individual consciousness. I have used a similar



idea in lectures sometimes that the way we humans think about nature is mostly about forgotten information. When a physicist tries to find a single equation to describe everything, he doesn't realise what he is doing. What he is actually doing is trying to reduce the very complex to a tiny little part of it. We people are very good at that, but it is always about reducing information.

Sometimes people ask me why nature can be described by equations so well. Well, it's because we humans are trained to reduce information. It's what humans do: We are continuously trying to find the essence by reducing the information available to us.

In talking to Ton, Sarah said: My hypothesis is that there are two types of consciousness. A universal form of consciousness and a subset of that, which is the sense of being a unique individual, distinct from others. I think that is the limitation we impose upon ourselves. Our senses limit the amount of information we perceive, meaning we can only perceive a subset of reality. That may be necessary for us to have the sense of being here, in the here and now, in order to live a life as a person in a seemingly fairly solid 3D world, with objects in it (*bangs on the table*). Objects that are built up of particles, that in turn are built out of particles that turn out not to be particles at all, but probability waves up until when you measure them. It seems to me that that is an illusion that we apparently need. So, I think that the sense of being someone, having the experience of being an individual, is part of the same illusion that leads to us perceiving the table as a solid object that makes a sound if I bang it.

Ton: But does that mean it is an incomplete observation? Do you feel the observation is incomplete? Is that what caused your childhood questions?

Sarah: Yes, I think it's an illusion, and it shows around the edges. I think if you came here, into this life, into this body in a 3D world with time as a nice linear phenomenon running straight through it, then you would have no reason to question

it, no drive to actualise, to understand more. For me, it is the fact that there are these unanswered questions – life, the nature of consciousness – and these non-sequiturs, such as in quantum mechanics, these 'cracks' in the nature of reality that make me want to question what is going on.

Integrating old wisdom into new thinking: the nature of greater consciousness

So, Sarah is suggesting that our individual consciousness may be part of a greater one. This is hardly a new idea, it is found in many religions such as Hinduism and Buddhism. Furthermore, several consciousness researchers have similarly suggested that consciousness (or awareness at least) may be an inherent feature of reality.[77] Henry said the following:

If you know anything about Indian philosophies, Hindu in particular, they have something called *Jivas*. There is the godhead, the sleeping, slumbering god, something that persists forever. Then, according to Hindu ideas, sparks partially disconnect from the whole and connect to a body. They become partially disconnected from the great godhead. In their way of thinking, you as an entity have two parts. There is your mental part, which seems to be separate in some sense from your bodily part. If you imagine the two disconnected, you can imagine yourself floating up into space, you can imagine that your body has decayed and has gone somewhere, but you still think of yourself as a mental thing that does not need the body anymore. The idea is not total nonsense. I mean, you can imagine it, you can think about it, and it is part of what made Descartes talk about mind and matter.

77 These include David Chalmers, mentioned in Chapter 2 and Christoph Koch, President of the Allen Institute for Brain Science, for example.

I think bodies are basically a way for the mind to have better communication with other minds. In other words, there is this material world that is a little more structured and stable and… We have no idea what these mental entities are doing, floating around up there, without bodies.

Ton: So their purpose is to communicate better?

Henry: Yes, with each other. You know, in most religions there is some reason behind it all and we have fates and karmas and things to work out. I have never been religious, but on the other hand I do feel that I am here for the purpose of doing what I am doing.

Ton: So do I.

Henry: I have the sense that I have a purpose and that somehow that purpose is expressed through my body, and that it connects to something that is more permanent, more enduring, that goes on and that has some sort of a reason that we don't know about yet.

Ton: I have come around to the idea that the world with you and me in it seems to be at work to convert entropic energy into more stable, more bundled, controlled energy. It seems it may be working towards more significance, more meaning, instead of chaos.

Herma van der Weide said the following about how our experiences may connect to a greater consciousness: in Jungian psychology, there is an axis in your psyche that connects the self to the collective. So, in principle, you can know everything. You are connected to all knowledge and it can present itself to you through images. Your mind translates the archetypes from the collective to images that fit you. The same topic will present itself to different people differently, according to their personal development, the culture they grow up in, etc. Each individual will translate topics from the collective into their own terms.

Ton: And it is a natural reflex for us to say it's just suggestion, or that we are imagining things.

Herma: That's the beauty of it: imagining things is transforming primal energy into consciousness. It happens through images.

Ton: Well, I meant that people suggest it is all just fancy. There is a push to prove it, to demonstrate it scientifically somehow. Don't you get that sort of reaction?

Herma: No, not really. When you work with individual people, the images they receive are very meaningful to them. They say things like: 'How on earth did this happen? I made it up, yet it makes perfect sense!' But their spouse, or somebody else might question it, simply because it does not have the same meaning for them.

Ton: So are these ideas incompatible with classical, empirical science? Are the two paradigms incompatible?

Sarah: They might appear to be incompatible at a first glance. But I think things are shifting. We are moving towards an interactive paradigm, where they will turn out not to be incompatible after all.

Herma: Exactly. I wouldn't go so far as to say that all contemporary science is merely positivistic,[78] but the very nature of what we currently need is that it can't be shown scientifically, because the way it manifests differs between individuals. The principle lies in the mysterious, and, well, we don't belong there.

Herman: Not yet, but it is where we are from.

Sarah: Is that the outcome of the evolutionary process that you refer to, Herman, that ultimately, in the end, we will all be 'enlightened', that we will return to a collective consciousness?

Herman: I consider that to be a possible destination of life. Alpha and omega, if you will: alpha, that we are experiencing an expansion of awareness in matter and that it will contract to a new consciousness, omega.

78 The idea that knowledge can only be derived from natural phenomena.

Wilber[79] speaks about 'transcend and include'. That is very important: to take what was important in an earlier phase, but transcend it and add new value to it. Really, it has been our experience that personal growth is no more than actualising the potential you represent, but that includes integrating the way in which you see the world.

This final chapter has gone back to the suggestion from Chapter 4 that reality may be a process and asked why such a process would be stable, and not random. We have speculated that another quantum phenomenon (the Zeno-effect) may play a role and that there may be an inherent tendency towards more complexity in all aspects of reality (a force countering entropy, if you will). Perhaps even more speculatively, some of the participants wondered whether awareness may not be an inherent aspect of reality and whether our individual consciousness (our sense of self) may then not be the result of that inherent awareness through brain function.

To be clear, the dialogues recorded here were (sometimes wildly) speculative and paint no more than an outline of the new paradigm we may be shifting towards. The final chapter will summarise the main points of what was said.

79 Kenneth Wilber is an American thinker who developed a theory on the nature of reality (Integral theory). His ideas on spiritual development emphasize building on what has already been achieved, by 'transcending and including' it in the next development.

7 Conclusions and possible implications

The last three chapters have tried to sketch a picture of the way our understanding of reality is changing. The authors have invited you to sit in on their conversations, so that you can make up your own mind about the ideas being discussed. As you can see, there is some consensus between the contributors to the dialogues on the form this understanding is taking. This final chapter briefly sketches this new paradigm by way of summary and then talks (even more briefly) about what some of the implications of viewing our reality this way might be.

In Chapter 4, we heard that reality may be a process that does not take on a classical, physical form before an observation is made. The participants marvelled at the puzzle of how making an observation can ever cause a possibility to take on a concrete form (Erik said about this: 'When the students ask, we tell them to stop asking questions and to just do the math.'), an issue that is not resolved by realising that probabilities do not actually come in the form of a wave. This raises the question of whether an active role needs to be reserved for a conscious observer. Some of the contributors went on to speculate that the underlying structure of reality may be something like quantum information, a sea of possibilities in motion which all aspects of reality (objects, consciousness, meaning) form out of and revert back to.[80] This conceptualisation is similar to some yogic teachings that stress that we are part of a larger whole. To name but one example, the Indian yogi and mystic Sadhguru has pointed out that we would be less inclined to cut down our forests if we considered trees to

80 This idea discussed with Alex is heavily based on the work by David Bohm and described in his 1980 book *Wholeness and the implicate order*.

be a necessary part of our breathing apparatus, responsible for producing the oxygen our lungs absorb.[81 & 82]

In Chapter 5, the participants reflected on quantum entanglement and whether it may play a role in the synchronous coincidences we sometimes experience in our daily lives. While there is no direct evidence for this, we learn that it seems safe to assume that entanglement is a much bigger part of our (physical) universe than we realise. The authors also note that such synchronous experiences often feel meaningful to us, and may even be useful to guide us towards the right path, as the expression 'being in sync' suggests.

In Chapter 6, the contributors noted that the process of reality seems to be stable and to have the (teleological) tendency to evolve toward more complexity, possibly because we focus our observations on the tail end of a Gaussian distribution. If it didn't have such a tendency, reality would be random. They then went on to speculate that awareness may be an inherent feature of reality. Our reality may then be formed by a dual-aspect Zeno-continuum binding together flashes of awareness on the one hand and physical reality on the other.

They went on to reflect on the nature of brain function, and the fact that our senses filter information, limiting the amount of information we have access to rather than maximising it. This realisation makes it tempting to speculate that the way we perceive the world around us is a simplification. It could also be taken to suggest that our (narrow) sense of self, individual consciousness, may be the result of this filtering. One speculative consequence of that may be that our individual consciousness is in fact a subset of a greater (even universal) consciousness that may form the dual aspect expression of our complex physical

81 In an interview with Anette Dixon, Vice President of the World Bank, https://www.youtube.com/watch?v=Qunpw46qxxk

82 You may notice that the authors have drawn some parallels between the dialogues and teachings from other philosophies. This is not coincidental. They believe it could be beneficial to our understanding of reality to reflect on the limits of our own framework by contrasting it with others.

reality. We note the similarity of this idea to some ancient religions and the ideas of some contemporary philosophers-of-mind.

Clearly the ideas discussed in this book are not well worked out, and in no way scientifically proven. The idea was not to provide a rigorous scientific model. Indeed, the authors feel it is too early for that. Rather, they wanted to sketch the changes that are taking place in the way we view reality. Such thinking is not yet widespread in science and the implications will only really become clear when these ideas have been further developed. As such, it may be too early to suggest implications. However, Sarah & Ton could not resist entirely, so here are a few early thoughts from the conversations:

Physics: Some of the implications from quantum physics seem to be that the reality we perceive around us is not so absolute and classical as we are used to thinking. The physicists we spoke to both indicated that the point of view of the observer, or the question asked by the observer matters. Furthermore, there is a lower bound to the level observations of external reality can be made at, as the energy that is necessary to make a measurement comes in minimal packages (quanta). However, Erik suggested that although we can't directly measure the underlying structure of reality (information) because of the observer effect, there may be ways to probe it, similar to the way Einstein deduced the existence of molecules.

Psychiatry and psychotherapy: One idea in this book is that there is an inherent tendency in nature to acquire more complexity, including in human beings. This would imply that people have a natural inclination to want to fulfil their potential and give meaning to their lives. This is something that can and should be capitalised on in psychotherapy and psychiatry, where it may be helpful to place less emphasis on diagnostic labelling and more on helping individuals identify their blockades and use their own capabilities to work around them. Ton has started using this in his psychotherapies and plans to write a paper on his professional experiences.

International relations: Alex said the following about implications for his field:

In my field, International Relations, the Newtonian picture of individual atomised states, conflict is the default mode. You just assume there is going to be conflict. And then the puzzle is, well how come states cooperate sometimes? In the quantum view, it is the opposite: Cooperation becomes the norm and conflict would then be the deviation. And so it comes down to a reversal of the burden of proof or what is taken for granted. I think if you take for granted that we are going to cooperate most of the time, if that is your starting point of the theory, it is going to lead to very different kinds of theorising.

The more quantum-oriented constructivist view is more social, more ideational. The dominant metaphor of the realists is billiard balls smashing each other, countries banging up against each other. Whereas for the constructivists, it is all about ideas and meaning.

Tipping point: One thing that was also discussed a lot was what is necessary for these ideas to penetrate further. Herman said the following:

That is where the tipping-point theory comes in. I often use that in lectures if somebody gets up and says: 'It's a great story you have, Herman, but it's never going to happen.' I say: 'It *is* going to happen, and let me tell you why.' And then I explain the tipping-point theory. I start with the physical world. For example, when water turns to ice, there is a tipping point where so many water molecules have aligned into a crystal structure that the rest follows. And then there is the story of the algae in the lakes in the Veluwe:[83] the lakes were clear, and suddenly they clouded in a single event. What happened was that nutrients from agriculture were leaking into the water and causing the algae to grow. When they reduced the nutrient supply, the lakes transitioned back to being clear in a single event again.

83 A national park in the Netherlands.

Ton: So, there is no gradual transition?

Herman: No. The work that you do with people individually in psychotherapy and the work that I try to do, mostly through lectures, is to try to 'recharge' people. We are trying to recharge the individual particles in society, so that they will view their realities from a different perspective. When enough people have achieved that, we will have reached tipping point and our common perception of reality will shift.

To conclude, Sarah and Ton feel that they have embarked on a wondrous journey exploring the limits of our (scientific) understanding and they wanted to share some of the wonderful conversations they had with you, the reader. Far from being able to present hard conclusions from these dialogues, they feel the reshaping of our paradigm has only just begun and are excited to see what direction our understanding of reality will take. Perhaps the most important conclusion they have drawn from these meetings is that we, as humans, have a great responsibility for the reality we inhabit. As Henry put it:

Ultimately, it's about us…

Lexicon

Actualisation: when a system realises its potential. The term is borrowed from Carl Rogers, the founder of the person-centred approach to psychotherapy, who used it to refer to human development. Henry has used it to refer to how the physical world takes form.

Atom: individual small particle. Frequently, used as a metaphor for the 'building blocks' of a larger whole.

Atomism: the world view that everything is built up from smaller particles. Close in meaning to materialist reductionism, where materialist reductionism places more emphasis on the possibility to explain higher-order phenomena in terms of their constituent elements.

Classical (world) view: the scientific paradigm on which most modern science is founded, where reality is assumed to consist of matter moved around by forces and matter is composed of particles. This view has been extended from physics and applied to most fields of science, including ones that cover more than the physical realm, such as biology, psychology, economics and social sciences generally.

Coherence: mathematically, (quantum) waves can be described as the sum of multiple waves. This is known as superposition. Coherence refers to a state when the resulting wave form is stable in time and space. Under normal circumstances, interaction with the environment (i.e. the addition of other waves) leads the system to lose coherence over time and collapse from its superposed state. This process is known as decoherence.

Complementarity Principle: principle from quantum physics that states that (quantum) particles have complementary properties that cannot be observed at the same time, such as wave and particle or position and momentum. Conceptually closely related to the uncertainty principle.

Consciousness: often used synonymously with awareness. There are many ways to define consciousness, and this book follows

Chalmers' definition of the 'hard problem' of consciousness: why it is like something to be a self. Here, awareness is considered to be a graded phenomenon, where an insect, for instance, may have some level of awareness (it can detect a hand approaching to swat it), but is unlikely to have the ability of reflection. It is awareness with the ability to reflect that is referred to as (individual) consciousness here. Greater consciousness in Chapter 6 refers to a consciousness that transcends such individual consciousness.

Constructivism: the idea that International Relations are due to historical and social interactions, rather than inherent to human nature or the system. Compare Realism. In philosophy, the movement that (similarly) argues that knowledge is derived from interpretation and interaction between (human) consciousness and reality.

Decoherence: the tendency of quantum systems in superposition to collapse into a classical state as a result of interaction with their environment.

Dualism: see Mind/body problem.

Emergence: when a phenomenon is created by other phenomena in a manner that cannot be predicted from its constituent parts. In philosophy, strong emergence relates to phenomena where the constituent parts are not recognisable in the emergent phenomenon. For example, aspects of the physical brain (or body) are not recognisable in consciousness. Sand dunes are an example of weak emergence, where sand, water and wind come together to form patterns.

Energy: property of an object that can be transferred to another object or of a system to perform work (physics). Constant property of a closed system, regardless of the level of entropy in the system.

Entanglement: term from quantum mechanics, meaning that two quantum particles can be entwined in such a way that when a property of one of them is measured, the value for the other is simultaneously determined regardless of physical

distance. Einstein famously called this 'spooky action at a distance'.

Entropy: the tendency of organised systems to return to chaos; opposite of formative (or teleological) tendency.

Epistemology: the branch of philosophy that deals with the nature of knowledge: what we do (or even can) know about the nature of reality. Contrast with ontology.

Formative tendency: the property of systems (with a certain degree of structure) to self-organise, to create more structure; opposite of entropy. Term borrowed from Carl Rogers.

Horizon: refers to the edge of our observation in cosmology. Black holes have a horizon beyond which we cannot observe what is happening inside them. But we also have a cosmological horizon, beyond which we cannot observe the universe.

Information: according to Erik's theory, information is the fundamental property underlying reality (including consciousness).

Materialism: the view that reality is built up from material (concrete) building blocks and that all of reality can be explained in terms of these building blocks and their interactions. Compare Atomism.

Meaning: the significance or worth attributed by an observer to something (an event, object, abstraction, etc.). Can be incorporated in the new understanding of reality, whereas it is not accounted for in our traditional view.

Mind/body problem: the question how the mind and body (or brain) interact. The issue goes back to Descartes who first described that there are two realms of existence, the physical (or material) world and the spiritual, or psychological, world, a notion known as dualism. Descartes postulated that the physical and spiritual realms interact in the pineal gland of the brain.

Neutral monism: the philosophical view that the physical and psychological (i.e. consciousness) are two different expressions of the same underlying (neutral) reality. Sometimes also called dual aspect theory.

Observer: (conscious) system that has been suggested to be responsible for creating reality by making an observation.

Observer effect: principle from quantum physics that states that certain (subatomic) systems cannot be observed (measured) without affecting the system. Sometimes confused with the uncertainty principle.

Ontology: the branch of philosophy that addresses the nature of being and reality. It asks the question what the underlying structure of reality is. It could be argued to be the sole topic of this book. Contrast with epistemology.

Panpsychism: the idea that awareness is an inherent part of reality.

Paradigm: framework for thinking about the nature of reality.

Possibility: infinite range of observations of reality that might be made.

Potentiality: possibility. The term was first coined by Aristotle, who contrasted it with actuality: a potentiality is the possibility of a 'thing' to become something whereas an actuality represents the situation once it has become real. The concept of actualisation is derived from this dichotomy.

Probability: the chance that a given observation will in fact be made.

Probability wave: the distribution of probabilities along a continuum. Such waves collapse into a single expression of reality when an observation is made, according to Schrödinger's visual imagery.

Rationalism: following the traditional logic of the Newtonian, atomistic paradigm.

Realism: philosophical school of thought that asserts reality exists independently of mind. In Alex's field of International Relations, realism specifically refers to the idea that world politics are due to conflict among actors pursuing power, either resulting from human nature or as a result of the system. Compare constructivism.

Reductionism: the view that everything in reality can be explained in terms of their constituent (often materialist)

elements. This includes explaining higher-order and potentially emergent phenomena, such as consciousness and meaning.

Reification: making something real, or concrete. Bringing it into being. Compare formative tendency, probability wave collapse.

Schrödinger equation: in quantum mechanics, the state of an atom is a 'smear' of all its possible states until it is observed. The Schrödinger equation captures that smear in mathematical terms.

Semiotics: the study of creating meaning. Traditionally the study of sign processes in meaningful communication.

Sufficient reason principle: the idea that nature has a reason to favour certain outcomes over others. According to Henry, nature favours outcomes that are positive for the observer. The notion is related to the idea of the formative tendency.

Superposition: term from quantum physics meaning that quantum systems can be in two states (or locations) simultaneously until measured when one or the other will be observed.

Synchronicity: when two (or more) meaningfully related events occur simultaneously. Compare to quantum term 'entanglement'.

Teleology: the property of systems to strive to greater complexity (or put simply: to grow). Teleological theories are largely ignored in science, as they are often assumed to imply the role of a creator (e.g. God). This book follows Tomas Nagel in asserting that teleology may be intrinsic to a system, and does not require an outside force, such as a creator.

Tipping-point theory: the theory that in any given system, if enough elements of that system have made a critical change, they will cause a chain of effect where all elements in the system transition to the new state.

Uncertainty principle: principle from quantum physics that states that if one of two complementary aspects of a quantum system is measured precisely, the other can only be determined with a certain level on uncertainty related (mathematically)

to the Planck constant. The two best known complementary aspects of such quantum systems are position and momentum. Conceptually the uncertainty principle is closely related to the complementarity principle and sometimes confused with the observer effect.

Zeno-effect: the property of quantum systems that once an observation has been made and reality has taken a certain form, this form is maintained and carried forward as long as observations continue to be made in quick enough succession. If observation ceases its observation, its form recedes to entropy and infinite possibility.

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