FOLDING INSTRUCTIONS: HOW YOU PUT BACK EMPTY SPACE IN ITS COVER

Jan-Willem Romeijn
translation Klaas Koetje

Introduction

You stay at home staring at an atlas or you open the door and leave. These actions seem different, but in reality, it is very difficult to do one thing and not the other. First, the map-reader easily thinks of herself as being on a river if she follows the blue curvy line on the paper. But also the traveller, finding her way with a travel guide, usually positions herself between destination and booklet. As soon as insecurity gets the upper hand, the traveller returns to the predictability of overview travel maps by means of which a decision can be made. “You are here” is written on the city map as if it wants to say: as long as you are standing here, you are basically on the map itself.

The difficulty repeats itself on the ground floor of our existence. If you close the atlas and walk out the door without a traveling guide, you let your eyes wander over an abstract map, a map so familiar it goes wholly unnoticed. We constantly find ourselves in the uniform space, the space of geometrical axes, which is the space we have learnt to draw in school. Though apparently inevitable, I think this space is a map, albeit the highest possible abstraction of a map. This abstraction I take as the subject of my essay. I will describe it, but at the same time look for the folding lines in the map to return it to you folded at the close of this essay. When you leave for Beetsterzwaag, it is best to leave it at home.

Empty space

If you pump all air from a flask, you are left with something rather strange: empty space contained in glass. That is to say: inside the flask there is empty space. A substance that has the same emptiness all over the world, the same transparent lightness. Hollowing out the space in the flask on a laboratory-table results in the same empty space as anywhere else in the world. The empty space in a studio in Groningen is the empty space in Beetsterzwaag is the empty space on a bus on the way to Islamabad. Empty space is the same everywhere.

A term like 'empty space' is actually a kind of denial. This term deals with the denial of the presence of something whatsoever, or in another word, it deals with nothing. So we can say that the term empty space denotes nothing. Still, it does not indicate nothing like the terms ‘square circle’ or ‘the king of France’ indicate nothing. These lasts terms refer to something that doesn’t exist. To avoid confusion, we might, instead of nothing, speak of ‘the nothingness’. But of course, the question is whether there is a difference between ‘nothing’ and ‘the nothingness’. In other words: does the nothingness exist?

Space as a thing

According to the philosopher Rene Descartes, this was chrystal-clear. Thinking is immaterial and non-spatial. It exists independently of the material world. The world, as opposed to this, is material and spatial. Its essence is extensiveness. So apart from the space we have in mind, the space of mathematical objects, there is a space independent of our thinking, the space which is matter and pure extensiveness. The thought that empty space is everywhere, and that it is the same everywhere, originates from Descartes.

This Cartesian understanding of space met response from the physicist Isaac Newton, who provided a convincing argument for this view. In a rotating bucket, Newton argued, the water stands up against the side, whereas water level in a non- rotating bucket is flat. This is also the

case in an entirely empty universe, that is, in an entirely empty space. But if the empty space itself did not exist it would be impossible to tell the difference between a rotating and a non-rotating bucket in the empty space. For only if empty space indeed exists, there is something in relation to which the bucket rotates or stands still. So because the rotating and the non-rotating bucket differ in the shape of the surface of the water, it must be the case that empty space exists. How are we otherwise supposed to explain the shape of the water in the bucket, if we cannot say that the bucket is rotating?

Space as a thought

Nonsense, claimed Gottfried Leibniz. We cannot meaningfully think about an empty universe, let alone put a bucket of water in there. Where should this bucket be placed? Here, there, or maybe a little further to the left? These kinds of questions on places in an empty universe are meaningless because there is no difference between places in empty space. Empty space in Beetsterzwaag is exactly the same as empty space in Groningen. To avoid an abundance of non-sensical places, Leibniz argues, we should renounce the existence of empty space.

This discord lasted until the German philosopher Immanuel Kant submitted his own hands to cutting-edge investigation. He wondered what it is that makes one hand left and the other one right? How is it that a left hand does not fit into a right-hand glove? Of course this is because, seen from the palm of a hand, the thumb is left to the fingers and not to the right. But with this answer, the terms ‘right’ and ‘left’ are not explained, so that nothing is really cleared up. In short, whatever Kant tried, it appeared to be impossible to explain the leftness of a hand without referring to some form of leftness itself. He could not formulate an explanation of left- and right-handedness in terms of simpler or more elementary empirical facts.

Kant concluded that left- and right-handedness are not inherent to the things themselves. If they were, it would have been possible to clarify left and right in terms of these things. Apparently, as Kant argued, left- and right-handedness are inherent to the way empty space is structured, even before we experience things as being localised in space. But how can we, in a proverbial sense of speaking, put our hands on this empty space before all experience? It is not something we are able to get to know through experience; we cannot investigate this space with a plummet or a folding rule. This empty space is, according to Kant, a pure intuition, a scheme of order that we have to impose on our experiences.

An imaginary cube

There they are: x, y and z. All the events we experience, every move we make fits into the proper cube of Cartesian coordinates. It is the way space is, that is, the structure of space. Anyone inquiring where Beetsterzwaag is knows in advance that it has to be somewhere within that imaginary cube, for otherwise it would not exist. And anyone asking himself what the space in Beetsterzwaag is like will be under no illusions of this most basic structure of space. A triangle in Beetsterzwaag has the exact same mathematical laws and relations as in Amsterdam. But is this a discovery, a structure we have uncovered in the world? Or is it merely a construction, something we have agreed upon to be able to see the uniformity of all Beetsterzwagen? According to Kant, then, it is a construction, but a construction outside of which we cannot imagine anything.

How fixed is the space that is preconceived and constructed by us? Mathematician Henri Poincaré put a little message in a Paris morning-paper stating that in the middle of the night the entire space, with everything included in this space, had discontinuously changed in size. Exactly at twelve o’clock, everything – houses, people, rivers and measuring tapes too – had suddenly

expanded. The obvious problem was of course: nothing or nobody was able to find out how much bigger the space had become. And this was precisely what Poincaré meant to say with his absurd message in the paper. The structure of space is to some degree an agreement, a convention. Only after we have made several agreements we are able to use space as a scheme of order for the world.

In the second half of the nineteenth century, schemes of order were made up that strongly differed from the imaginable cube; schemes in which space was curved or in which space could grow. The best-known example of this is the general theory of relativity by Albert Einstein. He showed that falling objects and planets in orbit may be understood in two separate ways. We can imagine the space around the sun as a static scheme and conclude that the sun keeps the planets in a curved orbit. However, we can also maintain that planets are moving in a straight line while space curves away from the sun. Indeed, with Einstein space has reached the peak of abstraction and schematization.

Internalised space
Research of the Russian psychologist Vygotsky suggested that internalizing external systems of symbols is an inevitable component in the development of our cognitive abilities. Our understanding of space can serve as an example of this. Via the Kantian conclusion that in order to have experiences we need an intuition of space, we arrive at a schematic understanding of space as the basis of our perception of the world. That is, space here serves as a map by means of which we may measure experience. This is a map that we can hardly leave at home, because it is carved in our educated minds.

Yet this map still shows the lines by which it was folded in the beginning, and this enables us to put away the map. With Descartes and Newton space was outside, or present as a thing, and with Leibniz and Kant space was inside and present in thought. This internalization is the essential folding line and the question arises as to how the unfolding was brought about. From where, precisely, did the thoughts emerge that managed to incorporate the space, which was initially placed outside of us?

Space as movement
It requires some imagination, but most people are quite capable of imagining what it would be like to be a plant: a slow living creature that is, unlike us, rooted and therefore does not experience movements through space. It is a creature that, apart from some wandering desert-plants, lacks the experience of traveling. In this perspective it's not a miracle that plants do not have eyes or ears. It does not need these tools for the purpose of coordination. Similarly, a plant lacks a nervous system and a fortiori a hooded and encapsulated brain. A nerve-protuberance like that is only necessary for a high level of mobility.

We need only a few steps of thought in the same direction to get to the conclusion that humans can think because they have no roots, that is, because they cannot feed themselves from the soil. We can put ourselves in the position of plants, exactly because we are nothing like plants in this respect. To illustrate this, we don't have to go further then this very paragraph. The metaphors of thinking are all based on movements: steps of thought, to get to conclusions, to put ourselves in a position, to go further. All thinking, as the Swiss psychologist Piaget wrote, is an internalized form of movement.

Folding lines
Unfortunately, our imagination is not flexible enough, or perhaps too flexible, for further

speculations on the life of plants. It is more in the line of this essay to connect empty space and thought movement. Because if we follow through the idea that all thinking is a result of our freedom of movement, our understanding of space may be brought back to the space we actually move in. The abstraction, the idea, is in the end something that originates in the physical capacity of moving. At first, space was transformed to a map in thought, but now the thought is made into movement in the body.

It is crucial that we have not returned to where we started. Empty space is not necessarily the thing Descartes had in mind. But more importantly, thinking is not the separate substance it was to Descartes. We have to get rid of the idea that thinking is an independent faculty, apart from body and world, and instead we have to look at it in its psycho-physical realization. As soon as we do this, it is clear that an independent understanding of space is never accomplished in a stand-alone brain. If a map of space is indeed filed and arranged in our thinking, the world itself is used to keep this map up to date and in shape.

In recent years, this thought has been worked out and applied to robotics and artificial intelligence. Instead of giving robots an internal representation of space, they only receive a series of navigational instructions by way of a map. Just like we can remember the lyrics of a song only by singing it, these robots know how to find a spot only by knowing how to move. Strictly speaking, they know nothing of the space they move in. The success of these robots in imitating the navigation-talent of humans, in contrast to the clumsiness of their map-reading predecessors, makes it plausible that we ourselves are not map-readers of space at all.

Instructions
Here, I can be brief: it is not difficult at all to put space back in its cover. As we stand still and watch empty space, space unfolds itself internally and we are not able to imagine that this internal map of space will ever disappear. But in the act of moving in the world, the map has disappeared. Automatically, we fold it up again. So in short the instruction is: move.