

A map is not the territory, or is it?

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‘A map is not the territory’ is a mantra introduced by the Polish-American mathematician Alfred Korzybski in an essay on the meaning of representation which he published in 1931. In it, he makes the very obvious point that an abstraction of something is not the thing itself and he uses the concept of the map to enforce this point. We all know what a map is. It is picture of the territory but with many details, in fact most details omitted. It may be similar to the thing but it can never be same. Korzybski’s thesis is a closely argued treatise about how close a representation must be to the thing it is associated with and in grappling with this problem, he implicitly defines a model, echoing to an extent the concept of the ‘digital twin’ that is preoccupying us somewhat in contemporary discussion of how we should build and use simulation models. In a previous editorial last year (Batty, 2018), I introduced the problem where I argued that such a digital twin must be an abstraction from the thing itself to which it is twinned. It may approach the thing itself but it can never be the same for the twin is a model as defined by an abstraction. Tomko and Winter (2019) took me to task in a rather gentle way for blurring this distinction in my saying that a twin is not the real thing but implying the twin needs to get as close as possible to the real thing. If we do get close, then the abstraction and the thing itself begin to merge. This does not quite reach the point where the twin is absorbed with the thing being abstracted but it does suggest that as our world – whether it be societies, cities, building complexes, etc. – evolves, then the digital landscape which hitherto we have regarded as something rather separate from the actual landscape begin to merge, producing a new landscape that is a mixture of both. We will elaborate this point below for it is intrinsic to the way in which material and digital societies relate to one another.

There is another qualification that we need to make with respect to a model. In my editorial I said: ‘Models are, by definition, simplifications of the real thing’ but in fact simplifications they may be but they are not necessarily of the ‘real thing’. Page (2018), in a recent interesting book where he argues that for most situations we should use as many models as we are able to clearly articulate, suggests that models may also be of ‘fictional systems’, not the real thing because the real thing may not yet have been and may never be invented. This is germane to the use of models, digital twins and such-like representations in our world which is inevitably and correctly about the future as well as the present and past. One of the reasons for doing any of this is to invent new futures which may well never turn out to be ‘real things’, notwithstanding the aspirations that we may have that this might be desirable. So in two short paragraphs, I have turned the definitions and implications of the term model and digital twin on their heads, such is our confusion over the semantics. And to some extent, this confusion is a necessary evil for it keeps us thinking about the meaning of any representation that seeks to get near to the real thing.

Korzybski’s mantra was preceded and succeeded by many others who have written about representations – in fact about maps in many instances – that attempt to capture all the

detail of the real world. Lewis Carroll, the author of *Alice in Wonderland* and much else, in his last work *Sylvie and Bruno Concluded* tells the story of a German professor who decided he would make a map as detailed as possible. The story is so good it is worth recounting because contained therein are all the problems that we face in defining a digital twin. In fact, myself and others were told this tale by the founding editor of this journal, Lionel March, in 1974 in a conference on land use models at Cambridge. The conversation goes like this:

'What a useful thing a pocket-map is!' I remarked.

'That's another thing we've learned from your Nation', said Mein Herr, 'map-making. But we've carried it much further than you. What do you consider the largest map that would be really useful?'

'About six inches to the mile'.

'Only six inches!' exclaimed Mein Herr. 'We very soon got to six yards to the mile. Then we tried a hundred yards to the mile. And then came the grandest idea of all! We actually made a map of the country, on the scale of a mile to the mile!'

'Have you used it much?' I enquired.

'It has never been spread out, yet', said Mein Herr: 'the farmers objected: they said it would cover the whole country, and shut out the sunlight! So, we now use the country itself, as its own map, and I assure you it does nearly as well'. (Carroll, 1893 [1982])

Somewhat later, Jorge Luis Borges (1946) in his essay 'On Exactitude in Science' more or less tells the same story of cartographers so obsessed with their art that they decided to produce the most detailed map of their Empire that they could make at a scale of 1 to 1. The next generations less enamoured of cartography than those who made the map had little use for it but Borges concludes by saying 'In the Deserts of the West, still today, there are Tattered Ruins of that Map', conjuring up images from the movie *The English Patient*. I wonder if the same fate awaits the digital twin: we will see. The folly of assuming the map is the territory lies at the root of many commentaries on science and abstraction from the writings of the philosopher-scientist Gregory Bateson to the economist Joan Robinson although Jean Baudrillard (1981 [1994]) in his *Simulacra and Simulacrum* provides a stronger rationale for merging the real and the abstract while David Gelernter (1991) in his *Mirror Worlds* (which I wrote an editorial here when the book first came out (Batty, 1992)) provides more hope for the basic idea of the digital twin.

There is, however, another force that threatens to change our notion of modelling forever and this involves the idea that the real is continually changing and never remains the same. If what we are attempting to represent is being continually transformed, this implies that our models need to be continually transformed as well but there is the possibility that this very transformation is a consequence of us developing those models in the first place. Let us examine what we know about cities in this light. Until the mid-20th century, the key components that we considered we needed in thinking about in cities were physical in nature seen largely through form and function. In the last 50 years of the last century, this changed to incorporate ideas about social and economic functioning, about cognition and perception all of which were key to what we called the city. Since then, the impact of digital technologies has been critical and as part of this, our ability to support our interventions in the city and our decision-making at every level with computer models and new forms of 'big' data is becoming

extensive. Computers have thus become part of the way we make decisions and we cannot now understand cities without thinking of this digital means for understanding and prediction as being part and parcel of the object we are studying. In the same way, half a century ago, planning came to be seen as part of the problematic of the city, manifest in the notion that planning was part of the problem in cities that we were sought to solve. This is no more or less than saying that we are part of the system – a sort of Heisenberg’s uncertainty principle for the social sciences in general and cities in particular.

If our methods and models are now part of the system, they become part of the real thing. Thomas Friedman (2016) suggests that the digital revolution continually produces layers of new software that get absorbed into existing software, incorporated in such a way that this builds up layers of complexity that are hard to unravel back to their elements but which we learn to live with. In short, we absorb the digital into the material. If thinking about a digital twin for, let us say, a building, then currently it might be a building information model which contains all the components of the 3D form supplemented by a whole range of materials, energy flows and even ways in which the building is used geometrically and cognitively. The software initially is separate from the building itself but in time, simply to maintain the building, the software is needed continuously. Slowly but surely it becomes part of the building itself. In this sense, the digital twin merges with its physical twin and there may be other twins relating to human behaviours that need to be incorporated into the whole system. Doubtless we could write a history of a number of physical systems, now often called cyber-physical systems, that illustrate how these additional functions come to be incorporated in the system itself. Perhaps we should do this for cities as we now have enough material from when computer models were first invented to be able to draw on a large number of examples and case studies.

In this sense then, the digital twin becomes part of the material twin or the physical twin which in any case may contain elements of a behavioural twin. The very notion of the twin begins to change in this process as the twin evolves, elements of which are being continually incorporated into the system. In an evolving system where information as well as energy is paramount, the digital twin is continually being redefined as it merges with the real thing, indeed becomes the real thing. In this sense, then, *a (the) map is the territory* and this implies that we need to rewrite the rules of how we approach modelling and simulation in much of science and social science.

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Editor

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