# The new world of digital drugs

***by Tony Cornford***

> Digital Drugs: noun, pl.,
> *drugs that are dependent on and substantially constituted by multiple digital representations and connections, and whose use and effectiveness is strongly mediated through digital means*

In his recent book *The Nature of Technology*, the economist and complexity scholar Brian Arthur identifies three core ideas underlying technologies of all types: 1) an intention to fulfil some human *purpose;* 2) an *assemblage* of practices and components; and 3) future innovative *potential* achieved by drawing on available repertoires of components and engineering practices. The drugs used in providing healthcare are an important contemporary technology, and these three ideas are central to understanding the ways in which they become digital.

The digitalization of drugs is serving to refine, expand and refocus the human *purpose*. For example, personalized medicines drawing on digital genomics brings that purpose down to an individual body or a small and distinct sub-population. Pharmacovigilance using digital data on use shifts the purpose to new knowledge practices that operate at the macro level.

Like other technologies, drugs have always been *assemblages* of various components **–** molecule in specific dose, physical form (pill, capsule, cream, etc.), protective packaging, instructions and warnings, etc. This assemblage includes practices (e.g. of prescribing, of dispensing, of consuming), and these are increasingly embodied in digital algorithms.

Drugs are understood and valued for the *potential* they hold for innovation and thereby achieving better fit to our evolving human purposes. This potential is realized as and when new components (e.g. digital technologies) and an extended repertoire of practices are mobilized – both in the underpinning science and in care giving.

**Drugs as solutions**

Healthcare places great reliance on the technology of drugs as a primary means of making therapeutic interventions and delivering care. Drugs are also a significant part of health budgets – a little over 10% of NHS costs (£14.4bn) in 2013-14. 40% of this spend is in hospitals, almost all the rest is in primary care.

As new health challenges are faced, from an ageing population and the growing burden of chronic disease to the outbreak of Ebola, we look to new drugs as solutions. Sometimes new avenues do open up such as in the treatment of hepatitis, and the recent experience of Ebola shows how rapidly vaccines can be developed, tested and targeted. But new drugs as new molecules still arrive in rather small numbers. The US FDA approved just 41 new therapeutics in 2014, up from 27 the year before.

One response is to redirect the innovative potential to ways of making better use of our old, existing drugs.

Of course, 'better use' may mean many things on the way to more positive health outcomes and lower costs. For example, it may suggest more evidence-based prescribing practices and protocols (including personalized medicines), as well as greater attention to safety issues and the

prevention of Adverse Drug Events (ADE) – injury or harm involving medication use. 'Better use' may mean a new emphasis on less costly generic drugs, or more efficient dispensing and administration of medicines with less waste. It also may mean easier and more consistent access to medicines and more information and hence understanding and adherence by patients.

All of these versions of 'better' have appeared in UK policy in the last decade and have seen the launch of associated initiatives. One important common theme that links together all these versions of 'better' and associated initiatives is the *digitalization* of drugs and medicines – and the resulting emergence of what we term Digital Drugs.

**The digitalization of drugs**

The word digitalization implies three interconnected things. First, the encoding of drugs' data into a digital format – *digitization*. Second, the accumulation of such data into substantial databases available as resources to support decision making and action of all kinds – *datafication*. Third, the resulting shifts of the locus of action (agency) that results as these resources are exploited – *agency migration*.

Agency migration may be from people towards the computer algorithm, as in a computerized decision support tool for a prescriber. But shifts occur in other ways. For example, a new mobile phone linked smart glucose meter may shift action and decision making from a health professional to a diabetic patient.

When resources are digitally encoded (*digitized*) they follow a new economic logic. Digital goods are in economic terms 'non-rival' – my consumption of a digital resource does not prevent yours; digital resources have far lower marginal costs – approaching zero since they are infinitely and easily copyable; digital resources are also highly recombinant – they are modular, and allow accumulation, rearrangement, substitution, and hence innovation.

So when, in order to achieve some specific desirable version of 'better use', specific computerization efforts are undertaken and data is taken 'on-line', it inevitably pre-figures more substantial changes in how drug technology will evolve as well as reconfigurations of how care is delivered.

It is not a perfect analogy, but as music went digital in its recording, its 'processing', and its distribution, so did the music industry change under the pressure of the new economics. Arguably, so too did the essential character of music itself and how we experience and use it – the earbuds on a busy tube train are rather different to the hush of the concert hall or the smell of the summer festival.

One example of reconfiguration around digital drugs is seen in the decade long experience of electronic prescribing systems in hospitals as they come to combine and coordinate the prescribing, supply and administration of drugs (so called 'closed loop' systems), and become more linked to electronic patient records as well as to dispensing and distribution systems.

The data collected from these primary activities, and the interactions between them, can then be repurposed in multiple ways in areas of management, clinical research, audit and quality, safety and professional development. At the macro level this data allows the identification and recalibration of outcomes and side effects and thus inviting a reassessment of efficacy and risk – the basis for economic, scientific and regulatory judgments of value.

Indeed, something even more significant occurs when a 'drug' is as much formed in its multiple digital representations as it is by an active molecule. And the practices assembled in it are founded in a set of digital resources and services that permit rapid and continuous readjustment.

**Further information**

The **Delivering Digital Drugs** (D3), a project recently launched at LSE, aims to investigate the digitalization of drugs and the associated transformations underway in the distribution, regulation and use of medicines. The project is funded by Research Councils UK as part of the 'New Economic Models in the Digital Economy' programme (grant reference EP/L021188) See http://www.digital-drugs.org/.

D3 brings together an interdisciplinary team with co-investigators from LSE, the University of Leeds, UCL, Brunel and The Health Foundation. The project draws on contemporary theories of the digital economy (digital health economy), digital artefacts and digital work. These include ideas of new business models, digital platforms, new organizational capabilities, the shift to services and service ecosystems.

**About the author**

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