rather than telling what they ought to know, hence all the prompts and pause-points.

Chapters on globalisation and ownership feature *Big Brother* and Rupert Murdoch. The ideology chapter perhaps tries to cram a little too much in: Marx, Gramsci, Althusser, Chomsky and Foucault all vie for our attention. The aforementioned 'Re-presentations' chapter does have an excellent case study on the word 'Chav', its journey to a signature term for working class youth, and a chapter on audiences finally reveals the raw mechanisms for media research. The final 'New Media' chapter is perhaps the most revised part of this edition, and includes a comprehensive account of the Arab Spring, and how it was represented across an array of different media.

Rather than the standard summary conclusion, *Understanding the Media* ends by directly asking students to do their own media research, and gives them a real sense of what that might look like.

If a student started at the beginning, and worked methodically and chronologically through this book, dipping out to the toolkit when prompted, there is no doubt in my mind that they would gain an awful lot of understanding, and would be well-set for their undergraduate studies. The problem is perhaps that students do not read books in that way anymore – if they ever did – and undertaking all of the tasks, as well as presumably their undergraduate essays and fieldwork, is not going to be a mean feat. However, it is no surprise that *Understanding the Media* has become a classic student textbook, and I feel this is down to the author's understanding of his students, his careful preparation of case studies and the wealth of supplementary material he makes available online.

Reviewer – Richard Berger. CEMP, Bournemouth University, UK

Software Takes Command, Lev Manovich (2013). Bloomsbury, ISBN 9781623567453

Lev Manovich made a major contribution in 2003 with the first comprehensive study of the poetics of new media. When I read his assertion that the most frequently watched animation in the world was the 'page loading' icon on Internet Explorer, it felt like someone was looking at 'new media' quite differently: at the cultural media dimensions of digital environments, in the same way one might study a film, an advert or a magazine.

That book was also an ambitious history of these media: one with an argument, plotting a powerful trajectory that ought to change how we think about digital experiences, texts and culture. The origins of computing, he claimed, were in the Jacquard looms of French and Flemish weavers in the later eighteenth century; they influenced Babbage's 'computational engine', itself the precursor of Turing's Universal Computing Machine, by

when computing had become adapted to crunching the kind of data that manifests only as numbers. It's taken another several digital generations for computing to return to the loom, as a machine for weaving together other kinds of data – images, moving images, sounds, text, geo-locations; a break that Manovich traces to XEROX PARC's development of the Graphical User Interface in the 1970s, and in this book, to Alan Kay's Dynabook – a prototype media-making computer.

In this his latest book, the late 1970s is again an important moment for Manovich. This is when Alan Kay and Adele Goldberg announce that the computers that were emerging were doing more than putting old media side by side in new and interesting combinations; instead they called computers new single 'metamediums', transforming how data and representations of the world are brought to us, and how we co-create those representations. The computer has become (again) a 'cultural machine', producing hybrid facsimiles of the world, evolved in significant stages beyond data crunching and analysis. As Kay and Goldberg put it: 'A computer is a medium that can dynamically simulate the details of any other medium, and include media that cannot exist physically.'

So what is at the heart of this new metamedium, and why should that be of interest to media educators? The title of Manovich's book says it: software is now the engine behind all other media, transcoded into transferable bits of data, so that moving and still images, sounds, words, geo locations can be synthesised into single entities, in Apps, games, websites – new media forms. Computers are no longer hardware, but software; and software, he claims, has effectively replaced all other single, once-autonomous media…

Here's one example of the 'softwarisation' of media: the development of the 'plug-in' demonstrates how software make new media 'infinitely extendable', with filters for digital photography, for example, or the different types of paint tools, fonts and instruments that we take for granted in our everyday software applications. A paintbrush, in the old days, couldn't be thinned, thickened, refined, coarsened; you had to swap it for a different one. But in paint programmes you can extend the tools you use in scale and function across an almost infinite range, and all within the same programme.

Plug-ins are both 'media specific' tools, and 'media independent' operations. Manovich's key strength is in his close analysis and cataloguing of the functionality of software media, and in charting its historical development. For while all software media are fundamentally data, different 'legacy media' use different data structures: images, for example, are organized into 2D grids of pixels, or 3D line and shape vectors, underpinned by mathematical equations. You navigate all 2D images, in whatever software programme, using pixel-data; and all 3D image environments using vector-based data structures. But increasingly media platforms allow the co-existence of both forms of data, along with

others. Google Earth for example, hybridises pixel-based images, with 3D views, geo-location tagging, written text and sound. It is able to do this because a category of 'media independent' operations have evolved, many of them based on legacy media operations: cut and paste; search and find; zoom. Manovich points out the curiosity of 'scroll forward/ backward' arrows, derived from video playback, being used in pdf documents and web-browsers; or cut and paste, derived from text, being used to edit music. And of the universal application of 'view control' mechanisms, across all new media platforms, enabling us to look at documents, pictures, websites, first person shooter games, from a range of different perspectives and scales.

Hybrids, and hybrid metaphors derived from evolutionary biology, form the spine of Manovich's history of these developments. The hybrid that is the 'metamedium' of software is an evolutionary stage beyond 'multi-media', in which legacy media like photographs, writing and speech would be designed alongside each other on a webpage or CD-ROM. 'The universal adoption of software throughout global culture industries is at least as important as the invention of print, photography, or the cinema,' he claims.

Why should this matter for media education? Manovich is clear that media study is too far behind the softwarisation of media. The study of media production still follows the old media divisions, not the software authoring and systems that they share. And in policy, and education, we're still talking about 'media literacy' as though it's a singular concept, but without studying the thing that makes it so: the software that has made media into a many tentacled hybrid form. The study of software thus needs a history, and a poetics of its internal systems of organisation, and then, maybe, Manovich permitting, its own rhetorics.

The second reason why media educators should take note of the take-over of media by hybrid software is in the title of Alan Kay's 1997 Turing Lecture: 'The Computer Revolution Hasn't Happened Yet'. Kay's original vision for his 'computing metamedium', in his Dynabook prototype, was that it would hand over the means of creation and re-creation to consumers. This true democratisation of media has still yet to happen, and it only will, if teachers are in its vanguard.

Reviewer – Mark Reid, BFI/DARE, UK