

Luciano Floridi, *Information: A Very Short Introduction*, Oxford: Oxford University Press, 2010, xv+130, \$11.95, ISBN 978-0-19-955137-8.

Pedagogical introductions do not lend themselves to a critical review of concepts, especially if they are very short. Such texts can, however, be assessed on the basis of how well they present the scope of a research area. When that area is as broad as information itself, the task is tremendous. Thus, we know upfront, before opening the book, that it will have to be dense in places, and it is. Nonetheless, it represents a good and much needed cross-section of conceptions to get someone started in the area.

The text begins with preliminary comments on the information revolution, during which the author acknowledges the sudden escalation in the sheer quantity of information (comprehended in historical time) as we approach the “Zettabyte Era.” Though the roots of this revolution certainly go back to the invention of writing and were helped by the arrival of the printing press, the rather sudden development of ICTs (Information and Communication Technologies) in the 20th and 21st centuries warrant, according to Floridi, reconceptualizing our place in history, as we find ourselves at the dawn of a new era. In this context, he introduces two notions from his own work that together set the tone for the rest of the book. The “Fourth Revolution” is his term for this great sea change. Just as Copernicus, Darwin and Freud provided foundations that transformed our conception of what it means to be human, Turing heralds the start of yet another transformation. From this point of view, “we are not standalone entities, but rather interconnected informational organisms or *inforgs*, sharing with biological agents and engineered artefacts a global environment ultimately made of information,” which he identifies as, “the infosphere,” (p. 9) the second of the two notions mentioned above. The “infosphere” refers to the information environment that we, as *inforgs*, inhabit. Its sudden escalation in development invites a careful analysis of the nature and meaning of information itself. To this end, the book introduces the basic language of information (Chapter Two), before turning to some of its varieties: mathematical information (Chapter Three), semantic information, (Chapter Four), physical information (Chapter Five), biological information (Chapter Six), and economic information (Chapter Seven). The book closes with some reflections on information ethics (Chapter Eight) and then a short epilogue on “The Marriage of Physis and Techne.”

Throughout, the book is organized around the story of John, who one Monday morning turns the key of his car and nothing happens. The process of getting from this situation to what is needed for repair carries the reader through a variety of distinct kinds of information, the first of which is the “data-based definition of information” (p. 20) in which information is understood as data + meaning. This is a variation of the syntax/semantics distinction with an informational twist, because, here, syntax extends well beyond the grammar and rules of a linguistic system to the physical structure of John's automotive system more generally. Semantics, as elsewhere, refers to meaning. The cause of John's car not starting is semantically rich, even though John does not initially have access to this information. If he had, his problem would have easily been fixed. That a definite course of action leads to the needed repair indicates the difference between data and its meaning. The solution is there in waiting; it is still informative, though John lacks access to it. Consultation with the car's owner's manual and/or automotive experts renders what is already present explicit.

Chapter Two continues with some standard fare in the language of information, including the distinction between analogue and digital data, binary data, and a brief taxonomy of types of data in the form of 1) Primary Data; 2) Secondary Data; 3) Metadata; 4) Operational Data; and 5) Derivative Data. Interestingly, Floridi then calls attention to “environmental information,” or “the possibility that data might be meaningful independently of an intelligent *producer/informer*” (p. 32), such as the rings of a tree that indicate its age. Finally, Floridi makes an important distinction within the semantic conception of information, since it can be either instructional or factual. Instructional semantic information is procedural, whereas factual information is declarative and treated more carefully later in the book.

The *mathematical theory of information* (MCT) is the theme of Chapter Three in which the reader encounters Claude Shannon's quantitative conception of information that is known today as 'information theory'. Here information is dealt with in terms of the *amount* of information a symbol system can carry without concern about meaning. It is a “function of the possible outputs” (p. 41) as a logarithmic operation tied to the number of symbols in the system. A unary system is uninformative, since $\log(1) = 0$. A binary system can offer one bit of information, since $\log(2) = 1$, and a die with six possible symbols offers 2.58 bits of information, since that is the result of $\log(6)$. This highlights the notion that a symbol system can only be informative to the extent that its symbols *make a difference* and that the degree of informativeness is determined by the number of different fair combinations that the system can produce. Naturally, this notion of quantitative information is useful for considerations of the amount of information that can be stored in a finite space, transmitted over a broadband line, etc., even though it is information without meaning and hence quite a different conception than semantic information. Importantly, this chapter includes a look at the concepts of “entropy” and “randomness” which are worthy of comment since they figure quite differently into Floridi's Information Ethics (IE) and are, in the present context, a bit counter-intuitive. “Entropy is a measure of the amount of 'mixedupness' in processes and systems bearing energy or information” (p. 47). However, systems with low entropy are less informative, since more order decreases the number of random combinations a system can produce. The possibility of a greater number of random combinations produces more entropy, thus such a system is more informative. Though this notion is initially counter-intuitive, it makes sense if you think of information as leading to a decrease of ignorance. A unary system that offers the same answer to any question is absolutely uninformative because it creates no decrease in ignorance. The higher the degree of randomness in a symbol system, the greater the number of permutations that can decrease ignorance, hence the more informative the system can be. “Entropy” may be an unfortunate word in this context, as Floridi acknowledges, but it gets the job done and is not central to the “queen of all concepts discussed in this book” (p. 47), semantic information, the topic of Chapter Four.

Here, Floridi deals primarily with “factual” semantic information, defined accordingly: “*p* qualifies as factual semantic information if and only if *p* is (constituted by) *well-formed, meaningful and veridical data*” (p. 50). In a section titled, “The Analysis of Informativeness,” (p. 52) the degree to which this conception is constrained by MCT is discussed. Though at first blush it might seem that the two conceptions differ greatly because the former takes semantic meaning into account and the later is concerned only with quantitative aspects of information, things are not so simple, due to the Inverse Relationship Principle (IRP) which states that information is tied to unpredictability. Thus, as noted above, a unary system is uninformative, according to IRP because its outcome is completely predictable. This provides the basis for a probabilistic (hence, quantitative) theory of semantic information, first advanced by Bar-Hillel and Carnap, and, in

turn, leading to two problems, “the scandal of deduction” (p. 54) and the “Bar-Hillel-Carnap paradox” (p. 58). The former, provided by Hintikka, is based on the notion that since math and logic are tautological, meaning in turn that all conclusions are wholly predictable from their premises, both must be utterly uninformative. Floridi side-steps (or better, resolves) the issue by presenting the notion of “virtual information,” (I won't spoil the surprise), before moving on the “Bar-Hillel-Carnap paradox,” which states that “when the probability of p is actually zero, that is, p is impossible or equivalent to a contradiction ... p should be maximally informative” (p. 58). Of course, this makes no sense. Hence, the paradox. Floridi resolves this paradox by bringing the notion of truth to bear on a propositions informativeness.

Chapter Five turns to the notion of “physical information,” and its relationship to energy by way of the laws of thermodynamics. Seeing energy and information as related notions, leads to a puzzle known as “Maxwell's Demon.” This is because “information processes seem inevitably physical, hence based on energy transformations and therefore subject to thermodynamic laws” (p. 61). At the same time information processes can be used to regulate thermodynamic ones. The puzzle exceeds the scope of this short review, though to summarize quickly, “Maxwell's Demon” is a thought experiment that shows that energy can be treated as an informational phenomenon, or at least captured by the same physical laws, but, if so, then, it seems logically possible to use information to “defy entropy” (p. 64). A few resolutions are suggested, before Floridi turns to discuss “quantum information,” which uses the quantum states of particles to store “definable but still undetermined” (p. 66) information states, which allow a finer grain of information encoding and processing than notions based on Newtonian principles. In short, the qubit, the basic unit of data measurement in quantum computing, allows a greater number of possibilities (states) in the same space because of superposition and indeterminacy than the ordinary bit, with the result that “a register of 64 qubits could outsmart any network of supercomputers” (p. 67). All of this looks a little mysterious to this reviewer, and perhaps this section could be clearer, though it serves its purpose to get to the hint of an information metaphysics, in which we understand reality as “constituted by information” (p. 71). The chapter ends with an open question that carries us from physics to biology.

The next chapter on “Biological Information” will perhaps strike most readers as more conventional, or, at least easier to grasp than quantum issues in computing. Though an ambiguous term, as Floridi acknowledges, it nonetheless serves to get the reader to the topics of genetic encoding and the role that neurons play in a network that “manages information” about the environment and ourselves. This chapter basically consists of a quick run down on how information states are encoded on a DNA strand and how neural signaling works. It is a welcomed relief after the head scratching required by the previous chapter.

“Economic Information” occupies us next. The first part of the chapter introduces the notion of an informational good and its value within an economy. But this is not the real substance of the discussion, which will revolve heavily on “information-theoretic approaches to economics” (p. 91). Game theory provides a good example, and so Floridi looks at the role of information in it and, of course, the Prisoner's Dilemma, a bit of standard fare in game-theoretic analyses. Floridi continues with a brief section on “asymmetric information” that examines one-way informational relations as witnessed between a salesperson and an uninformed consumer. This leads to a discussion of “perfect information,” as apparent in games where all of the players have access to all of the information, such as sequential games like tic-tac-toe and chess. Finally in this chapter, the reader encounters “Bayesian information,” which is “discussed here because it helps us to

understand how underinformed agents might revise or upgrade their information” (p. 99) in contexts where they may need to do so.

At last, we come to a favorite topic of Floridi, information ethics. The scope of systemic change due to the information revolution significantly rearranges the ethical playing field. In this last chapter, Floridi argues that microethical approaches are too limited and that a new environmental ethics is needed based in information ecology and “whose main concern should be the ecological management and well-being of the infosphere” (p. 104). Here, he considers information as a resource, as a product, and as a target. The first two of these are clear from their names. Information as a target, however, arises “when *A*’s moral evaluations and actions affect the information environment” (p. 107). The chapter ends with an argument that information ethics must be a macroethics, that is, analogous to environmental ethics with the added notion that our environment is made up of information.

The book closes with a short reflection on the “Marriage of Physis and Techne.” The relationship between these two concepts (or rather their separation as seen in Aristotle, for instance) may have been carved too hard and fast, as Nietzsche has already noted. If we are animals in whose nature it is to make technology, then, of course, technology is natural and not some artificial aberration or departure from nature. Floridi, however, adds to this picture a certain urgency about why this long dichotomy needs to be overcome.

The scope of information studies already makes any “short introduction” to information difficult, nevermind a “very short” one. The most that one can hope for is a useful outline, as we have here. The story about John and his car helps to make the book more approachable, but, this is not as easy to read as Oxford’s other *Very Short Introductions*. It goes by very quickly in places and is perhaps beyond the ability of beginning undergraduates without the aid of an instructor. However, upper division undergraduates, graduate students and faculty looking for a quick introduction will find this text a nice catalog of ideas. Accompanied with lecture to lay out the broad context and address the fine details, this book will make a great supplemental text for several courses. It sketches a very complicated terrain evenly and appropriately; in keeping with Floridi’s other works, *Information: A Very Short Introduction* is fascinating, fair, and balanced.

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