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Douglas Hofstadter's *Metamagical Themas: Questing for the Essence of Mind and Pattern* is not the Hofstadter book people probably expected to eventually turn up in a Passages column, to be honest. And I do not want to disparage his most famous work; I read *Godel, Escher, Bach: an Eternal Golden Braid* (GEB) one Christmas vacation, I believe when I was in the eighth grade, and it was a revelatory and enchanting experience, with a profound impact on the course of my future life. But everyone knows about that book, and has an opinion on it; I think it's a literary masterpiece and even when it gets something wrong, it does so in an interesting way.

But "everyone" has read GEB. Passages is in part about exploring lesser-known books, and I think that *Metamagical Themas*, a collection of all of Hofstadter's columns when he took over the mathematical recreations [1] section of Scientific American from Martin Gardner in 198, is a wonderful book for software engineers to explore. Exploration is the right word. What's this book about? Consider the index, which is excerpted below:

"A-flat major Polonaise, Opus 53 (Chopin), 187
Airedales, 530, 702–3
Airkraft, 280 airplanes, knobbed, 294–95
Alan Turing: The Enigma (Hodges), 483–91
Alcock, James, 97
"algebraic" vs. "geometric" approach to Cube, 354
Algeria, 569
algorithms: for Magic Cube, 321–22; see also God's algorithm
Alice au pays du language (Yaguello), 157
ALL D 727–28
Allen, Woody, 486 Alligator, 312–14 All the President's Men (Woodward and Bernstein), 23, 586
allusion via form, 16, 23–24, 586, 698 alphabets: chemical, 30; circular, 579; Copycat, 570–72;
on grid (gridfonts), 3, 89, 171, 299, 481, 669, 737; knobbing, 240–45, 292; vertical and
horizontal questions of, 634; whirly, xix, 1, 87, 169, 297, 479, 667, 735"

(The last few lines of the index are separated by spaces, not line breaks, in order to keep this column from taking up too much of this issue of SEN).

An index is a wonderful thing, by the way, that we take for granted. It is, of course, an early anticipation of various computer science constructs that aid in the rapid retrieval of arbitrary information. Any good database text will include a chapter or two on indices, and of course the most charming and useful of all "data structures," the ubiquitous hash table, is a peculiar kind of index. The index arose with print, not just writing; it would be meaningless to a primarily oral culture, as Ong notes in *Orality and Literacy*, but it would be of little use to a manuscript culture. Only when the endlessly repeated essence of digital artifacts is anticipated, primitively, by print books, does the index come into its own. Ironically, full digitalization makes the index less

useful, again; why look at the index when you can search on your Kindle? Of course, under the hood, the search is likely using an index, but what is that to you, or you to Hecuba? However, the index as an aesthetic object, or a kind of abstract summary that encapsulates a book, endures. An index excerpt is one of the few ways to present the nature of a book like Hofstadter's: there is a lot going on here, and it is very hard to extract an "elevator pitch" description of *Metamagical Themas* from any portion of its index. This, itself, summarizes the book. Moreover, the aesthetic, computational, historical, examination of the index in this paragraph is, while not taken from *Metamagical Themas* (I made it up myself), representative of the concerns of this book.

Metamagical Themas is a book about patterns, and tools for thinking about patterns, and ways to look at and *enjoy* patterns. That sounds like a good book, but what does it offer to a software engineer, in particular? Well, it depends. It will probably not help you master agile or DevOps, per se, or avoid undefined behavior in C++. On the other hand, much of going beyond technical or "management" mastery of software, to the creation of enduring software systems, relies on an *aesthetic* sense. Reading a book like Kernighan's memoirs of Bell Labs, one thing that is obvious about the people who built the systems we still use is that none of them were unimaginative, humorless drudges. Knuth is playful, so we still use TeX; Ken Thompson likes a good chess problem, so the operating systems on my main computer and on the virtual machines I spin up to do work are both based on UNIX; Alan Kay once worked as a professional jazz guitarist, so I'm writing this on a tablet that isn't totally unlike the idea of a DynaBook [2]. Perhaps SPIN is a great, ACM Systems Software Award winning model checker in part because Gerard Holzmann is a skilled and enthusiastic photographer. You get the picture. Hofstadter is a computer scientist, his take on "everything under the sun" is often keyed to the computer, even when his topic is Chopin's Etudes, for example (there's almost as much about the software for graphing the opening of Opus 25 no. 11 in two colors as there is about how Hofstadter realized he wasn't capable of playing that one, after all).

Software is, fundamentally, active patterns of abstraction and concretion, organized by the mind. *Metamagical Themas* is a book of active patterns of abstraction and concretion, organized by the mind; some of these are, precisely, software (there is a whole section teaching LISP), and some of these are music, and some are typography. Following Hofstadter's mind as it explores these patterns is a way to broaden your own intuition for the best patterns, which is, to my mind, one of the best ways to become a better software engineer. Engineers of narrow interests cannot easily put themselves into a user's position; engineers of narrow interests seldom conceive systems that are not, essentially, much like other systems they have already seen; as Hunecker could have said, "small-souled" engineers cannot easily write large software.

Note 1: "Metamagical Themas" is, as you may have noticed, an anagram of "Mathematical Games."

Note 2: This book has lots of wonderful diagrams and pictures; this usually means one of two things. The first possibility is that the electronic edition will be awful, and destroy the pictures'

usability (for instance, consider the state of the maps in most e-books of something like the *Landmark Thucydides*, or even the ugliness of most source code listings in books). The second possibility is that the book will essentially be a pdf, and tied to one screen size: if your reading device is not basically an 8 x 11ish piece of paper, you're out of luck. Surprisingly, this book really works fine on a tablet, a screen, or even a little Kindle. Kudos to the publishers!