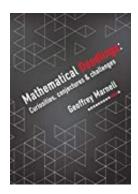# MATHEMATICAL DOODLINGS

Full Title: Mathematical Doodlings
Author / Editor: Geoffrey Marnell
Publisher: Burdock Books, 2017

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Review © Metapsychology Vol. 21, No. 45
Reviewer: Karl Pfeifer

The mathematics of doodling is a very small subfield of mathematics, popularized by advocates like Ravi Vakil [1], [4]. Moreover, the renowned John Conway tells us his famous game of Sprouts, a game with significant mathematical properties, originated in some tea-time doodling with the aim of inventing a good paper-and-pencil game [2]. Also, doodles have a large presence in children's mathematical education, although there it is generally not because of their interesting mathematical properties; instead, the doodles are mainly eye-candy for the purpose of providing a context that's supposedly playful and fun. The title of Geoffrey Marnell's book, *Mathematical Doodlings: Curiosities, conjectures, and challenges*, is therefore somewhat misleadling in that it

doesn't concern either of such doodlings at all. Rather, the book is a paean to doodling in a metaphorical sense, i.e. to a sportive exploration of the patterns to be found in numbers, by means of conjecture and trail-and-error discovery, which can be pursued by amateurs idly playing with numbers in order to arrive at plausible generalizations that might someday also be rigorously proved.

Marnell provides a short but useful discussion of inductive as opposed to deductive reasoning in mathematics, indicating how conjectures can be arrived at by examining numerous instances that suggest a possible generalization. And with computers nowadays, huge numbers of instances of a pattern can be easily investigated by "iterative computer analysis (using nothing more sophisticated than common-or-garden database and spreadsheet applications)" (p. 18).

Intelligence tests are apparently a huge burr under Marnell's saddle: he devotes a 3-page section of his introductory chapter to that topic, launches into a 26-page critical discussion of the kind of number-sequence and visual-pattern questions found on IQ tests, and then adds a further 29-page appendix on the topic. The main issue, as regards mathematics, is that multiple-choice questions asking for the next item in a sequence of numbers or diagrams have no unique correct answer; there are infinitely many correct possibilities, including all the choices on offer, that correspond to some pattern or rule (and there may be infinitely many of those too).

Recalling from my childhood several unavailing arguments with complacent and patronizing schoolteachers, I can empathize with Marnell's tirade. It would have been wonderful to have had his book available as ammunition back then. The continuing problem nowadays is that while many might be prepared to acknowledge *in the abstract* that there is
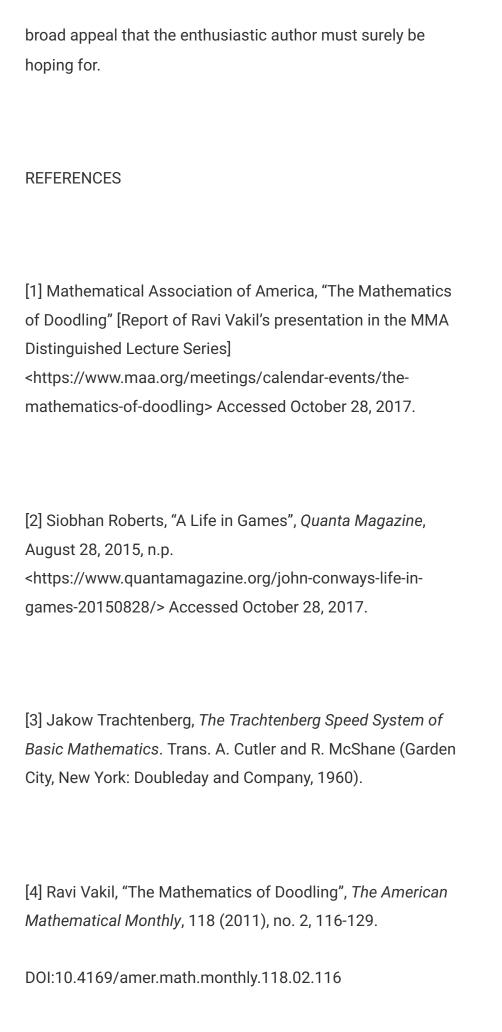
no unique correct answer in some ultimate metaphysical sense, they insist there is nevertheless a unique "best" answer that is a mark of a testee's intelligence. Various rationales exist for such a claim and Marnell debunks them all. He then concludes with a discussion of issues of social justice pertaining to the indiscriminate and discriminatory uses of intelligence tests. Although Marnell's claims and concerns about intelligence tests are not new, people do sometimes need to be reminded of what's true and what's at stake.

In his introduction Marnell refers to his two larger discussions of intelligence tests metaphorically as the "bookends of his work" (p. 17). Sandwiched between these bookends is a discussion of various arithmetic operations and techniques inspired by Jakow Trachtenberg's algorithms for rapid mental calculation [3]. Here Marnell presents various techniques involving shortcuts or special applications of the standard arithmetic operations on integers and digits that exhibit interesting and peculiar properties, throwing in an occasional conjecture and challenge for the reader. This is followed by a foray into prime numbers and Goldbach's Conjecture (and variations thereof). Inspired by Goldbach, Marnell continues with a dozen "prime conjectures" of his own, followed by a conjecture about repeating digits and a final puzzle for the reader. (This puzzle is answered in an appendix, as are the other questions Marnell has posed to the reader throughout.)

Clearly Marnell has a passion for numbers that he wants to share and encourage in others. However, unlike many other books in the genre of recreational mathematics, his book does not offer a smorgasbord of diverse mathematical curiosities. The items on the menu have all been prepared from the same basic ingredients and flavored with the same sauce. So the book will likely not have the

broad appeal that the enthusiastic author must surely be hoping for.

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