no point in treating a typist as if he were a back-alley numbers runner, to be greeted with a wink, a raised eyebrow, a shrug, and silence.

—The purpose of an abstract is to summarize, not to tease. Many authors find it painful to trot their results out naked before the world; they want to seduce, to captivate, to tantalize. What results is the abstract of the seven veils:

> An advance in the definition of certain operators is made possible by the application of several recent results in complexity. Full details are supplied, and illustrative examples are included. Data on related findings are presented in the final section along with implications for further research.

In other words, what's in this paper is a secret.

—Adding an exclamation point to a plain declarative sentence makes it not emphatic but pathetic. If you are ever in doubt about whether a sentence merits an exclamation mark, try shouting it out the window.

—When explicit motivation is necessary, be on guard against grandiose, far-reaching statements. Early in my career I had the task of correcting an extraordinary essay from a student that began, "All the world is turning to thoughts of mortuary science."

A book like this cannot really be reviewed. It can be (and is) recommended.

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Hyperspaces of sets, by Sam B. Nadler, Jr., Monographs and Textbooks on Pure and Applied Mathematics, No. 49, Marcel Dekker, Inc., New York, 1978, xvi + 707 pp., $45.00.

This book is concerned with the structure and topological properties of two hyperspaces 2^X and $C(X)$ of a metric continuum X. Here 2^X ($C(X)$) denotes the nonempty compact (and connected) subsets of X with the Hausdorff metric. Mathematicians started investigating hyperspaces in the early 1900s. In the 20s and 30s the Polish School of Topology determined much of the basic structure of hyperspaces. Their work culminated in J. L. Kelley's 1942 paper **[3]** which brought together several diverse aspects of the theory for the first time. In the 50s E. Michael wrote *Topologies on spaces of subsets* **[4]** and a series of papers on selections **[5]**, **[6]**, **[7]**. These papers were used to great advantage in studying hyperspaces. In 1959, J. Segal **[9]** obtained a useful inverse limit representation of hyperspaces. Then in the 70s D. W. Curtis, R. M. Schori and J. E. West **[2]**, **[8]** using newly devised techniques of infinite dimensional topology made an important breakthrough. They gave a positive answer to the long outstanding problem: If X is locally connected, then is 2^X homeomorphic to the Hilbert cube? More recently, H. Toruńczyk **[10]** has obtained an amazingly short proof of this result using his incisive characterization of Q-manifolds and T. A. Chapman's [1] result that any compact contractible Q-manifold is homeomorphic to the Hilbert cube.

So the history up to the present of hyperspace theory has been characterized by mathematicians applying newly perfected techniques to hyperspaces to determine more about their structure. There has never been an attempt to systematically treat the entire theory. Bits and pieces about hyperspaces usually appear in graduate texts on topology or in research papers as an application of other techniques. Nadler's book is the first to treat hyperspaces exclusively. More importantly, it is the first attempt to treat them from a consistent point of view. This is largely based on the notion of "Whitney maps". This idea was first applied to hyperspaces by Kelley (though originally due to H. Whitney). The use of Whitney maps permits a systematic treatment of many of the most important aspects of hyperspace theory, such as the basic arc structure, and constitutes one of the major successes of the book.

Philosophically, hyperspaces represent an attempt to understand how continua are constructed by examining the relationships of their compact (or compact and connected) subsets. This roughly corresponds to how coverings are used to determine polyhedra which are nerves of coverings of a space. Polyhedra so obtained give information about the structure of the space. In other words, another structure is introduced which carries some information about the space. The structure of such polyhedra is simpler than that of the original space. In the case of hyperspaces, some things become simpler but others do not. For example, consider a hereditarily indecomposable continuum X. It has an exceedingly complicated local structure (e.g., it contains no arcs) but $C(X)$ is uniquely arcwise connected. Moreover, these unique arcs help us to understand how the subcontinua of X fit together. On the other hand, $\dim 2^X = \infty$ and $\dim C(X) > \dim X$ if $\dim X < \infty$. More importantly hyperspaces have been used in a variety of different applications. In the early 40s it was still not known if there were higher dimensional hereditarily indecomposable continua. However, Kelley was able to relate the existence of such spaces to monotone mappings of a certain type. In other words, hyperspace theory made it possible to translate the original problem into another interesting problem. Hyperspaces often serve as a vehicle for such translation. In contradistinction to coverings and their nerves, hyperspaces do not discard the original space. The difficulty is finding out where X lies in 2^X or $C(X)$. Nadler shows how this is done in certain cases and why this is often the crucial question.

Nadler also intends that his book be used as a text for a second semester topology course in which the first semester covered the basic notions of topology. It is often difficult for a student to get started in such areas because there is so much unmotivated material. An approach which is solidly based and motivated such as Nadler's often proves effective in getting students working. There is no doubt that anyone working through the book will learn a great deal about the structure of continua and be forced to come to grips with such topics as dimension, selections, fixed points, ANR's and convexity. The book has the kind of geometric flavor which often attracts students to topology in the first place. A large number of exercises add considerably to the usefulness of the book as a text.

The book appears to be well designed for research purposes. One could read the first two chapters and then proceed to the chapter of particular interest. So one could learn the "state of the art" in hyperspace theory with respect to the topics previously mentioned. He would also acquire a statement of the research problems of current interest in this area. This makes the book "a must" for researchers in the field.

REFERENCES

1. T. A. Chapman, *Lectures on Hilbert cube manifolds*, CBMS Regional Conf. Series in Math. no. 28, Amer. Math. Soc. Providence, R. I., 1976.

2. D. W. Curtis and R. M. Schori, *2^X and $C(X)$ are homeomorphic to the Hilbert cube*, Bull. Amer. Math. Soc. **80** (1974), 927–931.

3. J. L. Kelley, *Hyperspaces of a continuum*, Trans. Amer. Math. Soc. **52** (1942), 22–36.

4. E. Michael, *Topologies on spaces of subsets*, Trans. Amer. Math. Soc. **71** (1951), 152–182.

5. ______, *Continuous selections*. I, Ann. of Math. (2) **63** (1956), 361–382.

6. ______, *Continuous selections*. II, Ann. of Math. (2) **64** (1956), 562–580.

7. ______, *Continuous selections*. III, Ann. of Math. (2) **65** (1957), 375–390.

8. R. M. Schori and J. E. West, *The hyperspace of the closed unit interval is a Hilbert cube*, Trans. Amer. Math. Soc. **213** (1975), 217–235.

9. J. Segal, *Hyperspaces of the inverse limit space*, Proc. Amer. Math. Soc. **10** (1959), 706–709.

10. H. Toruńczyk, *On CE-images of the Hilbert cube and characterization of Q-manifolds*, Fund. Math. (to appear).

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Skew field constructions, by P. M. Cohn, London Mathematical Society Lecture Note Series No. 27, Cambridge Univ. Press, Cambridge, London, New York, Melbourne, 1977, xii + 253 pp., $12.95.

A skew field, or division ring, is an associative ring with 1 in which every nonzero element is invertible. Why do we study such objects?

A natural answer is that they generalize fields, which are so important in commutative ring theory. But this analogy is not as strong as it seems. Skew fields generalize fields as characterized by the property that every nonzero element is invertible. But commutative fields have a number of other important characterizations. They are, for instance, the *simple* commutative rings. A consequence is that every nonzero commutative ring R has homomorphisms into fields, and the class of such homomorphisms (up to an obvious equivalence) gives a basic framework for studying R: It is (with a few extra trimmings) the "prime spectrum" Spec R of algebraic geometry.

It is similarly true that every nonzero associative ring has maps into simple associative rings, but these form a wider class than the skew fields. Two examples are the ring of $n \times n$ matrices over a field, and the algebra of operators on a polynomial ring $k[x]$ (k a field of characteristic 0) generated