International Journal of General Systems

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/ggen20

Concepts and fuzzy logic

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Version of record first published: 24 Sep 2012.

To cite this article: Mihai Nadin (2012): Concepts and fuzzy logic, International Journal of General Systems, DOI:10.1080/03081079.2012.726321

To link to this article: http://dx.doi.org/10.1080/03081079.2012.726321

International Journal of General Systems
iFirst article, 2012, 1–14

BOOK REVIEWS AND ABSTRACTS

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BOOK REVIEWS

Concepts and fuzzy logic, edited by Radim Belohlavek and George J. Klir, MIT Press, 2011, ix + 274 pp., ISBN 978-0-262-01647-6

There are books, many of them, that can be praised for the manner in which they settle a subject. In some ways, they are an end, a closure. (So was the still contested identification of the Higgs boson, believe it or not!) Encyclopedias would qualify as examples, so would textbooks (the *Foundations of*... type). Such books, as valuable as they are, do not open up a perspective. They are good photographs of a landscape at one moment in time. Consulted one day later (no exaggeration!), they remain, due to the circumstances of very rapid advances in knowledge and discovery, rather of documentary relevance. The number of such end-of-the-road (or dead-end) books is rapidly diminishing. There are other books that remind readers of an ongoing diagnostic process – and invite to action. For a reviewer, the first category of books is a test of knowledge (how complete, how precise, and how many errors), and the second category is a test of relevance. *Concepts and Fuzzy Logic*, edited by Radim Belohlavek and George Klir, is a well-designed case study. It consists of contributions that create a solid background for discussion. Most important, the book advances an understanding of how the science domain – concepts – and the methods of enquiry – fuzzy logic – can be successfully integrated. It is the meeting point between one of the most important subjects of epistemology – acquisition and expression of knowledge – and fuzzy logic as a particular scientific perspective and methodology for making acquisition and expression of knowledge possible. This is a book about learning the language of science and using it to define questions, to seek answers, and to share the results in the hope of further improvement. Let us dwell on this thought.

Belohlavek and Klir assembled a detective story that could have been entitled *The News of My Death is Greatly Exaggerated* (to use Mark Twain's formulation). Indeed, the two editors started gathering data about the 'crime' in the year 2000, when they learned that 'fuzzy logic had been found useless within the field of the psychology of concepts' (p. vii). The narration is quite simple: The 'shooting' occurred in 1981, and consequently,

ISSN 0308-1079 print/ISSN 1563-5104 online
http://dx.doi.org/10.1080/03081079.2012.726321
http://www.tandfonline.com

fuzzy logic was abandoned in the research of concepts. The editors and the authors contributing to the book are reputable scientists, known for their dedication to inter- and cross-disciplinary work. Their reconstruction of the 'crime' was not a vendetta (Those who tried to kill fuzzy logic must be punished!), rather an attempt to understand circumstances leading to damage inflicted, not to persons (although scientists feel hurt when their ideas are misunderstood), but to science. Over 10 years ago (in 2002), in this journal, Belohlavek and Klir, joined by H.W. Lewis, III and E. Way, took a position with respect to a text by Osherson and Smith (1981) that declared fuzzy logic inadequate for the study of concepts. At this juncture, it suffices to take note of the fact that Osherson and Smith had difficulty in putting experimental data in a fuzzy logic perspective. (More about their specific objections later.)

It is easy to uncover errors in a text or in an argument; it is way more difficult to make a case in favour of a perspective that was, for better or worse, declared inadequate. In terms of the detective story mentioned in the opening, the book correctly points to the fact that similar 'crimes' were committed in the past. Mentioning the famous Minsky and Papert's (1969) study of the perceptron provides the broader justification for the recollection of an incident from 32 years back. Indeed, when a voice of authority (Osherson, Smith, Minsky, Papert, or whoever might be wearing the blinders) gets involved, the consequences can be considerable. In fact, prior to Osherson and Smith's article, the psychology of concepts adopted a viewpoint congruent with that of fuzzy logic: degree of membership came up in publications; experiments informed by fuzzy logic were designed and carried out in a variety of locations; and funding supported the effort. Imprecise concepts (and which of them is not?) invite considerations of variables with fuzzy membership functions. After 1981, this changed. For those familiar with neural networks and connectionism, the same happened after Minsky and Papert took Rosenblatt's perceptron under their scrutiny. They did not reject it ('The perceptron has shown itself worthy of study'); rather, they claimed that it was inherently incapable of global generalization, and that even multilayer neural networks would not fare better ('The extension to multilayer systems is sterile'). Neither the editors of this book nor the various authors discuss the fact that publishing negative positions by authors of reputation *is* consequential, and not only for scientific dialog. After all, science advances not by reports on experiments but by confrontation of viewpoints. There is no such thing as the last word in science (the argument of authority even less). This is where the crime is committed. Hiring scientists who pursue a different path becomes problematic. Funding, even more so. Let us face it: at the Directorate for Social, Behavioral, and Economic Sciences (in particular the Division of Behavioral and Cognitive Science) at the National Science Foundation, psychologists had their say for the longest time. Consulting the list of successful applications shortly after Osherson and Smith's article appeared leads to the observation that grants were no longer awarded for research involving fuzzy logic. (In the case of neural networks, the computer science community, AI research, in particular, lost almost 20 years!) To be very clear: the integrity of the authors mentioned is not questioned here. They themselves, as far as is known, did not prevent any grant from being awarded, or the hiring of any applicant who did not align with their viewpoint. The politics associated with scientific authority turns one viewpoint against the others. Fuzzy logic has a long history of being undermined in the politics of science (especially in the USA), while in parallel proving its significance in a variety of spectacular applications.

This book review was suggestively framed as a detective story on purpose. Few, even among psychologists, would care for the psychology of concepts. Some of these few, sceptical of a science of concepts, would go so far as to maintain that there is no reason to

make a fuss over fuzzy logic being rejected. The rejection could only be detrimental to their research. Indeed, in our age of extreme specialization, the generality of *concept* and speculations about words are of marginal interest. Moreover, those somehow familiar with the field question its legitimacy, at least on account of its history. Arguments were presented within pragmatism with respect to knowledge and intelligence as originating in pre-linguistic activity. The psychology of concepts always denigrated what was not psychology, without ever having produced proof that concepts are psychologically defined. Those active in the field tried to appropriate philosophical, logical, linguistic, anthropological, cognitive, etc. explanations, such as those of Arnauld and Nicole (1662), Bruner, Goodnow, and Austin (1956), Goguen (1969), and Lakoff (1973). Fisher's (1916) work gives a broad account of introspective activity (almost half her book is a collection of reports). Hull (1920) adopted a behavioural perspective and generated interest in empirical aspects of concept awareness. Smoke (1932) finally brought up what in the first place should be of interest to anyone (psychologist or not): what do people do with concepts? The response and whatever the concept presents are of interest to him (although 'unknown neuromuscular and neuroglandular events that occur in the formation of any given concept' is more than a deterministic stretch).

Of course, there is no need for a reviewer to rewrite the history of the psychology of concepts. The editors entrusted to Edouard Machery the tutorial on concepts (Chapter 2). Machery is probably one of the most qualified for the task. If you want to learn about the field, especially about its most recent twists and turns, this tutorial will do. (If in need of more, read for example, his '100 years of psychology of concepts: the theoretical notion of concept and its operationalization', 2007.)

No less useful is the 'Fuzzy Logic Tutorial' by Belohlavek and Klir. Here it is time for a segue. In a very telling confession, Lotfi Zadeh mentions some of the adversities encountered by those active in the field he initiated. A short, but revealing, quote:

> In 1975, Professor William Kahan, a colleague of mine, a superior intellect and a Turing Prize winner, had this to say: 'Fuzzy theory is wrong, wrong and pernicious'. I cannot think of any problem that could not be solved by ordinary logic. What Zadeh is saying is the same sort of things: Technology got us into this mess and now it can't get us out. What we need is more logical thinking, not less. The danger of fuzzy theory is that it will encourage this sort of imprecise thinking that has brought us so much trouble.

The fuzzy logic tutorial is neither partisan nor missionary. I recommend this tutorial for students and scientists (even those not working in the concept definition area), as I recommend Machery's tutorial. Believe it or not, fuzzy logic is still not well known among those in academia, or even among those active in research.

The question of relevance with respect to the psychology of concepts (What is it good for?) can be asked also with respect to fuzzy logic. The first answer I would like to suggest has to do with the subject of the book. Recently, Meech (2011, University of British Columbia) submitted to an informal discussion on the significance of fuzzy logic a text entitled 'How some simple fuzzy thinking might have prevented the Challenger accident'. His concept is SAFETY. This comes from the knowledge domain of underground mining.

A crisp definition of SAFE/UNSAFE and the assumption that a Factor of Safety of 1.5 would be acceptable are considered in the decision making. By using crisp definitions of SAFE and UNSAFE, these terms are true and false, respectively, when the Factor of Safety lies at 1.5 or higher and are false and true, respectively, when it lies below 1.5 (Figure 1).

Once fuzzy reasoning is applied, it turns out that SAFE and UNSAFE are no longer mutually exclusive, but complementary (Figure 2).

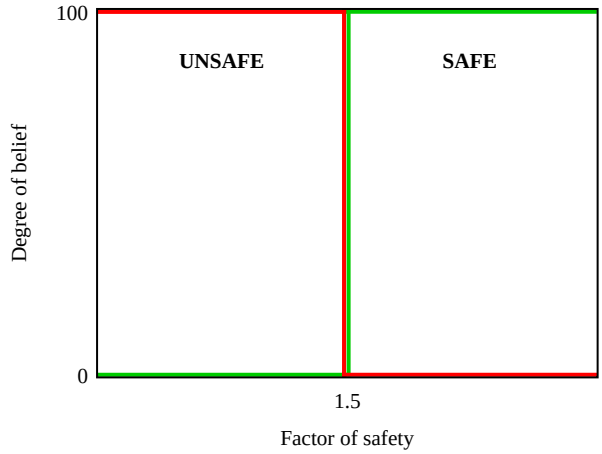

Figure 1.

More important: instead of a Factor of Safety, we now have a Degree of Belief. For higher values of the safety factor, the degree of belief increases. The question that the NASA engineers tried to answer was: is the O-ring integrity at low temperature a reason to worry?

Fuzzy logic changes the perspective. Let me quote Meech:

> In a binary system, irrespective of the Confidence Level, there is no change in the meaning of a Factor of Safety. But now if one uses the fuzzy membership functions with a Confidence Level of 80%, the Factor of Safety will move below 1.5, perhaps virtually guaranteeing that failure will occur as shown in Figure 3.
>
> For the dialog to remain on the same basis, the Confidence Level must change to 20% when the question becomes negative if the Factor of Safety is to retain the same meaning (Figure 4).
>
> So, by transforming the dialog into a negative instead of a positive evaluation, the engineers became confused about the meaning of Factor of Safety. When there is an 80% Degree of Belief in SAFE, this is equivalent to a 20% Degree of Belief in UNSAFE. We will never know if fuzzy thinking might have helped avoid this confusion, but there is no debate that the wrong decision was made using binary logic.

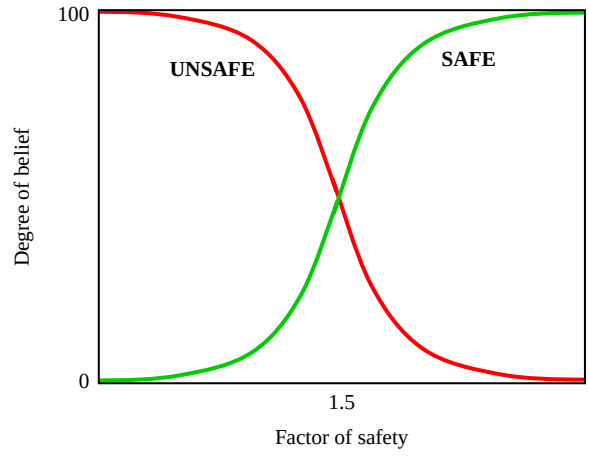

Figure 2.

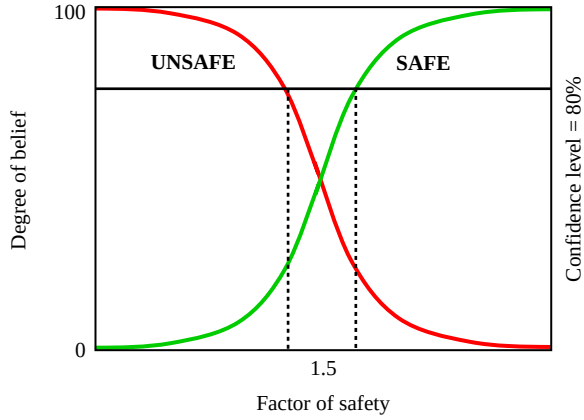

Figure 3.

Imagine now that somehow knowledge about concepts and fuzzy logic meets at the conception of a robot that will perform autonomously in real life. Labelling the world, which humans perform as a matter of fact, corresponds to concept building and use. The example from Meech (to whom I am grateful for allowing me to quote from his succinct paper) is indicative of a process of evaluation performed by the autonomous robot as it navigates the world and solves a variety of tasks (e.g. identifies dangerous situations, helps elderly, oversees the functioning of complex devices, etc.). Of course, we can argue whether not a robot will actually work on concepts or only on information. But there is no argument that such a robot will function in a meaning domain. ('Is that printer, packaged for a trans-Atlantic flight, actually what the label states, or is it a bomb?') The relevance of fuzzy logic with respect to concepts extends further. (I shall return to this at the end of the review.)

In what turns out to be the most enjoyable text in the book, Eleanor H. Rosch (Chapter 4) puts the whole enterprise in its real focus: given a scientific enquiry S_i, which are the means of enquiry M_i appropriate to the task? Better yet: does the question define the tools or do the tools shape the question?

Scientific enquiry → Means of enquiry
Means of enquiry → Scientific enquiry

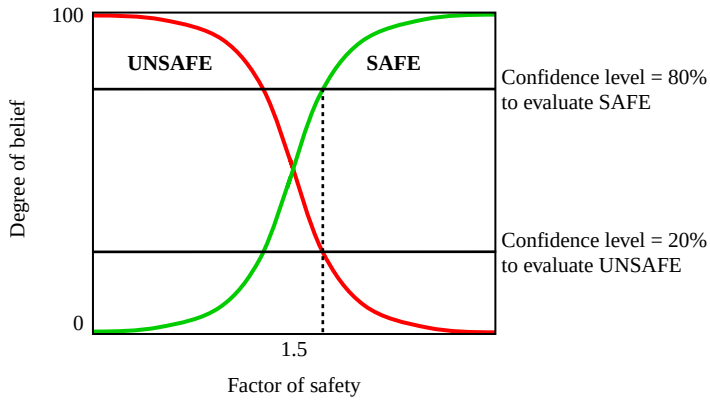

Figure 4.

Occam's *lex parsimoniae* (i.e. keep it simple, as his law of parsimony is known) aside, there are no efficient means for deciding what is necessary and what is superfluous. (Even so many years after the birth of the fuzzy perspective, it is still considered as unnecessary in some circles.)

Her view is as simple as it is clear: 'People have different modes of using their concepts, and they are quite flexible in switching among them' (p. 108). Dogmatism was never a good guide; ignorance even less. How does the scientist find those representations that promise to help in assigning meaning to the data? Osherson and Smith rejected fuzzy logic because their experimental data triggered questions. It turns out that this happened against the background of the 'Ill-Conceived Assumption That Fuzzy Set Theory is a Theory of Concept'. On analysing the text (cf. 5.4.1), Bělohlávek and Klir identify the following fallacies:

- Arguments regarding logically empty and logically universal concepts. This is in reference to conjunctions and disjunctions of complementary concepts.
- Failing to acknowledge the expressive capabilities of fuzzy logic. This is in reference to the concept of financial wealth $W(x) = f[L(x), I(x)]$ as a function of liquidity $L(x)$ and investment $I(x)$. Osherson and Smith ascertain that f is maximum (fuzzy disjunction, union), which would contradict their experimental data. The reason for their error is that they do not know that function f can be more than what they assume it to be (e.g. it can be a non-standard union).
- Set inclusion and universal quantification misunderstood. This is in reference to the truth degree of propositions, in particular the fuzzy truth function.
- Technical errors in using fuzzy sets.

The analysis is factual, very precise; the conclusions (well tempered) are quite convincing. It is worth quoting:

> In this chapter, we discuss and correct the many misunderstandings, misconceptions, and oversights regarding the role of fuzzy logic in the psychology of concepts that are repeated again and again in the literature of this field, and are accepted, by and large, uncritically. (cf. 5.5)

In the process of debunking some of Osherson and Smith's arguments, Bělohlávek and Klir express their own view of fuzzy logic. This view is consonant with mathematical formalism. Bělohlávek, in the chapter he authored ('Formal Concept Analysis: Classical and Fuzzy'), offers a very solid method that combines two different, though related, perspectives.

By no means would this review underestimate all other contributions. The book is intended not only to address an error (and its consequences), but even more to open new avenues. 'Representing Concepts by Fuzzy Sets', by J. Verkuilen, R.A. Kievit, and A.Z. Scholten and Bělohlávek's 'Formal Concept Analysis: Classical and Fuzzy' illustrate this intention. The examples that follow (the issue of 'Conceptual Combination and Vagueness' authored by James A. Hampton) are more suggestive for what is 'cooking' in the 'kitchen' of the psychology of concepts. But they also point to those characteristics of fuzzy logic, which are still debated in the scientific community (in particular the definition of the membership function). That semiotics remains *terra incognita* (or even a place to run away from) for psychologists is not surprising. Too bad. That Peirce's *Logic of Vagueness* (Nadin 1980) is ignored might be as relevant as the rejection of fuzzy logic. That concepts might be constructs seems to be a unanimously ignored position. Again: too bad, since the construct *fuzzy logic* has been subjected to the criticism that reality (whatever that is) is not fuzzy. Constructs, such as circles, numbers, words, sets, concepts, and so many others, are the

embodiments of new gnoseological perspectives. They open avenues to knowledge and to new applications. Osherson and Smith missed the point and identified fuzzy logic with a theory of concepts only because, initially, concepts (bold, tall, good, etc.) served as examples of graded descriptions and of weighted memberships. But those were examples. As we know, arguments based on examples can succeed only when the examples disappear, i.e. when the level of abstraction definitory of science is reached. Western civilization never outgrew the old confusion between names and what they stand for (nominalism vs. realism). In all fairness, a constructivist perspective would have given this book even more convincing power. One more reproach: given the nature of the subject (concepts are expressed in the form of words), the possibility of computing with words (yet another extension of Zadeh's fuzzy perspective) is a natural suggestion (as controversial as fuzzy logic itself).

In the months of reading and re-reading this book and researching adjacent subjects, I had two experiences related to what this book is about. First: pursuing my interest in the subject of anticipation (which psychologists have difficulties relating to), I took note of a sloppy use of the concept (Nauts, Metzmacher, Verwijmeren, Rommeswinkel, and Karremans 2011) and provided a critical statement (Nadin 2012). The authors would not take the matter of concept discipline at heart, and would argue that the dictionary meaning confirms their use. (Lucky me, they did not refer, as many do, to Wikipedia, the new authority in matter of everything.) Of course, the use of concepts cannot be legislated more than morality can. But Peirce, in arguing for an *ethics of terminology*, warned that progress in science depends to a large extent on the proper use of concepts. Second: I took note of an interesting set of new questions focused on the notion of degree of belief, degree of confidence, and related topics. A long (and protracted) discussion on uncertainty [within the Berkeley Initiative in Soft Computing (BISC)] brought up the never-ending contradistinction between fuzzy descriptions and probabilistic descriptions. Fundamentally, for me these are issues of representation. We describe the world as we experience it. Some descriptions are more helpful to what we do than others. Those descriptions are not always independent of each other. Each representation simultaneously constitutes the reality it describes. But this is already a bit outside the subject of the book under discussion. The concept of uncertainty is intuitively related to probabilities (actual, statistical data, such as in the uncertainty of weather, of extreme events, of market behaviour, etc.). Some researchers (Dimitrov, Koshelev, and Kreinovich 1997), focused on acausal processes, showed that such processes lead to non-statistical uncertainty. Their hypothesis is that fuzzy logic is appropriate for describing 'highly unprobable' events (such as those they study in astrophysics). Am I wrong in assuming that concepts are 'highly unprobable' occurrences associated with human activities? The question is a hypothesis (abduction) worth pursuing.

It would be naive to interpret the experiences I have described as the seal of approval for fuzzy logic. Neither does the book make such a claim. But it suggests that the bridge among sciences is built as we progress in our more comprehensive understanding of ourselves – as the originators of concepts – and of the world – about which concepts say something, not always very useful, or not immediately well understood.

References

Arnauld, A., and Nicole, P. (1662), *La logique, ou l'art de penser*.

Bělohlávek, R. (2004), 'Concept Lattices and Order in Fuzzy Logic,' *Annals of Pure and Applied Logic*, 128, 277–298.

Bělohlávek, R., Klir, G.J., Lewis, H.W. III, and Way, E. (2002), 'On the Capability of Fuzzy Set Theory to Represent Concepts,' *International Journal of General Systems*, 31, 6, 569–585.
Bruner, J., Goodnow, J., and Austin, G. (1956), *A Study of Thinking*, New York: John Wiley.
Dimitrov, V., Koshelev, M., and Kreinovich, V. (1997), 'Acausal Processes and Astrophysics: Case When Uncertainty is Non-Statistical (Fuzzy?),' *Bulletin for Studies and Exchanges on Fuzziness and its Applications (BUSEFAL)*, 69, 183–191.
Fisher, S.C. (1916), 'The Process of Generalizing Abstraction; and Its Product, the General Concept,' *Psychological Monographs*, XXI, 2.90, 1–209.
Goguen, J.A. (1969), 'The Logic of Inexact Concepts,' *Synthese*, 19, 325–373.
Hull, C.L. (1920), 'Quantitative Aspects of the Evolution of Concepts,' *Psychological Monographs*, XXVIII, 1.123, 1–86.
Lakoff, G. (1973), 'Hedges: A Study in Meaning Criteria and the Logic of Fuzzy Concepts,' *Journal of Philosophical Logic*, 2, 458–508.
Machery, E. (2007), '100 Years of Psychology of Concepts: The Theoretical Notion of Concept and its Operationalization,' *Studies in History and Philosophy of Biological and Biomedical Sciences*, 38, 63–84.
Meech, J.A. (2011), 'How Some Simple Fuzzy-Thinking Might have Prevented the Challenger Accident,' 7 April 2011, BISC discussion group.
Minsky, M., and Papert, S. (1969), *Perceptrons: An Introduction to Computational Geometry*, Cambridge, MA: MIT Press.
Nadin, M. (1980), 'The Logic of Vagueness and the Category of Synechism,' *The Monist*, 63, 3, 351–363.
Nadin, M. (2012), 'What is Anticipation and What is Not? Comment on Nauts, Metzmacher, Verwijmeren, Rommeswinkel, and Karremans (2011),' *Archives of Sexual Behavior*, 41, 753.
Nauts, S., Metzmacher, M., Verwijmeren, T., Rommeswinkel, V., and Karremans, J.C. (2011), 'The Mere Anticipation of an Interaction with a Woman Can Impair Men's Cognitive Performance,' *Archives of Sexual Behavior*, 41, 1051–1056.
Osherson, D.N., and Smith, E.E. (1981), 'On the Adequacy of Prototype Theory as a Theory of Concepts,' *Cognition*, 9, 35–58.
Smoke, K.L. (1932), 'An Objective Study of Concepts Formation,' *Psychological Monographs*, XLII, 191, 1–46.

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Anticipatory systems: philosophical, mathematical, and methodological foundations, by Robert Rosen, 2nd edition, with contributions by Judith Rosen, John J. Klineman, and Mihai Nadin, New York, Springer, 2012, lx + 472 pp., ISBN 978-1-4614-1268-7

Robert Rosen, a mathematical biologist, frames his book with a question raised by Robert Hutchins, 'What ought we to do now?' It is an ethical question. It is also a planning question, a design question. Indeed, Rosen conceived the book while working with Hutchins at the Center for the Study of Democratic Institutions.

While reading the first chapter, you will become quickly convinced that this is not a typical scientific book: there is a text within the text, a personal narrative, and a host of philosophical, and especially ethical, discussions. The author's literacy is wide ranging – Rosen is conversant in biology, category theory, physics, and Aristotle – and this provides

ABSTRACTS

Handbook of mathematical fuzzy logic (2 volumes), edited by Petr Cintula, Petr Hájek, and Carles Noguera, College Publications (King's College London), 2011. Volume 1: 468 pages, ISBN 978-1-84890-039-4, Volume 2: 928 pages, ISBN 978-1-84890-054-7.

Originating as an attempt to provide solid logical foundations for fuzzy set theory, and motivated also by philosophical and computational problems of vagueness and imprecision, Mathematical Fuzzy Logic (MFL) has become a significant subfield of mathematical logic. Research in this area focuses on many-valued logics with linearly ordered truth values and has yielded elegant and deep mathematical theories and challenging problems, thus continuing to attract an ever increasing number of researchers.

This two-volume handbook provides an up-to-date systematic presentation of the best-developed areas of MFL. Its intended audience is researchers working on MFL or related fields, who may use the text as a reference book, and anyone looking for a comprehensive introduction to MFL. Despite being located in the realm of pure mathematical logic, this handbook will also be useful for readers interested in logical foundations of fuzzy set theory or in a mathematical apparatus suitable for dealing with some philosophical and linguistic issues related to vagueness.

The first volume contains a gentle introduction to MFL, a presentation of an abstract algebraic framework for MFL, chapters on proof theory and algebraic semantics of fuzzy logics, and finally, an algebraic study of Hájek's logic BL. The second volume is devoted to Lukasiewicz logic and MV-algebras, Gödel-Dummett logic and its variants, fuzzy logics in expanded propositional languages, studies of functional representations for fuzzy logics and their free algebras, computational complexity of propositional logics, and arithmetical complexity of first-order logics.

The universal computer: the road from Leibnitz to Turing, by Martin Davis, CRC Press (Taylor & Francis Group), Boca Raton, FL, 2012, 224 pages, ISBN 978-1-4665-0519-3.

The breathtakingly rapid pace of change in computing makes it easy to overlook the pioneers who began it all. Written by Martin Davis, respected logician and researcher in the theory of computation, this book explores the fascinating lives, ideas, and discoveries of seven remarkable mathematicians. It tells the stories of the unsung heroes of the computer age – the logicians. The story begins with Leibniz in the seventeenth century and then focuses on Boole, Frege, Cantor, Hilbert, and Gödel, before turning to Turing. Turing's analysis of algorithmic processes led to a single, all-purpose machine that could be programmed to carry out such processes – the computer. Davis describes how the incredible group, with lives as extraordinary as their accomplishments, grappled with logical reasoning and its mechanization. By investigating their achievements and failures, he shows how these pioneers paved the way for modern computing. Bringing the material up to date, in this revised edition Davis discusses the success of the IBM Watson on *Jeopardy*, reorganizes the information on incompleteness, and adds information on Konrad Zuse. A distinguished prize-winning logician, Martin Davis has had a career of more than six decades devoted to the important interface between logic and computer science. His expertise, combined with his genuine love of the subject and excellent storytelling, makes him the perfect person to tell this story.

The P = NP question and Gödel's lost letter, by Richard J. Lipton, Springer, New York, 2010, 239 pages, ISBN 978-1-4419-7154-8.

The P = NP question is one of the great problems of science, which has intrigued computer scientists, mathematicians, and systems scientists for decades. Despite the abundant research regarding this question, it has not been solved. The book covers historical developments (including the Gödel's lost letter), the importance of P = NP, and the future of this problem.

Growing wings on the way: systems thinking for messy situation, by Rosalind Armson, Triarchy Press, Axminster, UK, 2011, vi + 331 pages, ISBN 978-1-908009-36-4.

This book is about the use of systems thinking for dealing with messes – messy situations, messy problems, and the like. The term 'mess' was coined by Russell Ackoff for any problem situation that defies a definition of the problem in a way that makes it soluble. The author views systems thinking as 'a style of thinking that attends as much to the connections between things as to things themselves, and to the connections between things and their wider context, and looks at things and their connections from more than one perspective'. Each aspect of this view is discussed in the book in detail together with proper argumentation that systems thinking is the right way to deal with messes. The book is primarily oriented to managers, team leaders, and policy makers.