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**Dialogue with Bernard De Baets
by Raúl Pérez-Fernández**

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by Martin Stepnicka***

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INTERVIEW

Dialogue with Bernard De Baets



I am pleased to present an interview with Prof. Bernard De Baets, an inspiring personality in the field of fuzzy set theory and of whom I had the luck to be PhD student.

Raúl Pérez-Fernández: Let us start from the beginning. You are really interested in languages and, in particular, in the etymology of words, so did you – as a little boy from the outskirts of Ghent (Belgium) – always know you wanted to pursue a career in science, or was it a choice that was shaping itself as university was nearing?

Bernard De Baets: Career planning is a term that probably did not exist when I was young, or, at least, I never heard of it. That was in the pre-internet era with a small community library as only window to the world. You are right that I have a keen interest in languages, and, in particular, in etymology, but I never considered this as a possible study direction, let alone a potential job. As a boy from the countryside, I was more interested in the bioscience engineering program at our university (back then less attractively called agricultural engineering), but when weighing my limited knowledge of chemistry at the time against my mathematical skills and my

interest in the emerging personal computers, the choice for mathematics, option computer science (it was not yet possible to study computer science) was quickly made. Although I was not always impressed by our physics-dominated bachelor program (to my opinion, the why was too often neglected by our mathematics professors), it shaped me into a broadly trained mathematician with sufficient programming skills.

R.PF: If my calculations are correct, you entered university around 1985 and decided to study mathematics. Do you think you could have been more interested in other career options (I am thinking of informatics) if you would have been born 30 years later?

B.D.B.: I entered Ghent University in the fall of 1984 and decided to study mathematics for the reasons explained above. However, if I were to start again in 2020, I would definitely go for computer science, although I see that field becoming too much of an experimental science nowadays.

R.PF: In the early 1990s you started reading about fuzzy logic, how did that happen? What was the role played by your PhD supervisor (Etienne Kerre)?



B.D.B.: Actually, I first heard of fuzzy set theory (I prefer this term over the term fuzzy logic) in 1987, when having to decide the elective courses for our final year of master studies. Although the course title sounded mysterious, the choice was quickly made as the professor teaching the course was by far my most favorite one since my first year at university. Indeed, this was Prof. Etienne Kerre. For the same reason, I decided to do my master thesis under his supervision, getting introduced to the Dempster-Shafer theory of evidence, and studying the many papers on possibility theory sent to us by Didier Dubois and Henri Prade. Looking at it now, my thesis was not about fuzzy set theory itself, but about topics closely related to it. This seems to apply to many of my later activities, such as my involvement in the study of aggregation functions. The Artificial Intelligence buzzword at the time was expert systems and the language of the future was LISP. So I wrote the software accompanying my master thesis in



Golden Common LISP, a forgotten functional programming language that was very natural to mathematicians.



R.PF: All in confidence, was your relation with fuzzy set theory love at first sight?

B.D.B.: Yes, I was charmed right away by the appealing idea that everything is a matter of degree, and that mathematical notions could come in shades. Fuzzy set theory provided the language to formalize such degrees, reason about them and actually compute with them.

R.PF: So, some years passed and you obtained a professor position at the Faculty of Bioscience Engineering at Ghent University. I am sure you do not regret it at all nowadays, but was leaving the Faculty of Sciences a hard decision back then?

B.D.B.: Obviously, joining the Faculty of Bioscience Engineering was not my ambition at the time. From 1990 to 1999, I was a doctoral, and subsequently postdoctoral research fellow of the FWO (Research Foundation Flanders), the most prestigious grant system in Flanders, and my dream was to obtain a permanent FWO position. Little did I know that politicians would decide in the spring of 1999 that we no longer needed permanent researchers (all scientific problems were solved?). Since my postdoctoral scholarship was finishing end of September 1999 and although I acquired another yet final 3 year grant, having two daughters and one son on the way (although we did not know it yet), my wife and me figured that it was time to end living on scholarships. Right at that time, there was a vacant professor position in applied mathematics at our Faculty of Bioscience Engineering. Although the position had been created with another specific person in mind, and the procedure was long, tiring and hostile, I came out as victor. At first, I did not really feel at ease in my new faculty, but this soon changed after starting collaborations with several interesting colleagues. So after all, the circle was round. The faculty that I hesitated to join as a student in 1984 turned out the one I joined as a professor in 1999, something that could have never happened if I had started at that faculty in 1984. I never regretted this career move, it shaped me into the applied mathematician I am now. It often still comes as a surprise to EUSFLAT friends that fuzzy set theory should rather be seen as my hobby for the past 20 years, while my main activities are situated in hydrology, microbiology, biotechnology, environmental science, food science, and many more, as can be seen from my

list of publications.

R.PF: Quick fast-forward now to September 2019, you received the EUSFLAT Scientific Excellence Award and the citation read as follows: “For his excellent contributions to the theory of fuzzy sets and preference modelling with applications in distinct fields including bioscience engineering.” I feel that like you more and more people are moving towards multidisciplinary science nowadays. How do you feel about this natural evolution of research?

B.D.B.: I think this is indeed a natural evolution and would encourage all EUSFLAT members to get involved, even if it is only for a minor part of their activities, in intra- or interdisciplinary research. It usually is very challenging, but serves as a source of inspiration for new directions in basic research as well. Being able to explain to people (friends and family) how one’s research contributes to solving real-world problems (I prefer societal over industrial problems) is very rewarding. At the same time, it gives the opportunity to learn a lot about other fields of science, their state of knowledge, their habits, even their ethics.

R.PF: Just a small aside topic, the Climate Change Conference has just taken place in Madrid and has made more noise than ever, constantly appearing in the news. I know most of the people at the Faculty of Bioscience Engineering have been very active in the topic and ratified a list of good practices for researchers. What is your opinion on the topic?



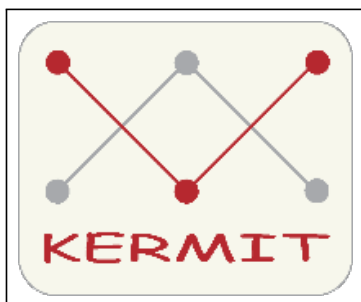
B.D.B.: Obviously, we should not waste time discussing whether or not climate change is happening or is going to happen. What more evidence does one want? What is more important is how to take countermeasures without becoming dogmatic. I strongly believe that one can redirect industry or even develop new profitable industry focusing on these problems, similarly as Flanders is exporting its knowledge on the design and operation of wastewater treatment plants.



Climate change, environmental pollution, loss of biodiversity, should be grasped as opportunities for change, rather than protesting in the streets demanding politicians to take action. The solutions have to come from scientists and industry. In the meantime, in order to increase awareness and guarantee public involvement, one has to communicate feasible steps that every citizen can take. Education is the key to all. Flanders has become the top region in sorting waste at home, after elementary school students being taught at school stimulated and educated their parents how to do it.

R.PF: Back to the life and travels of Bernard De Baets, around the same time that you entered the Faculty of Bioscience Engineering at Ghent University, you started your own research unit (KERMIT) in 2000. Where does the name come from? I assume KERMIT the frog came to mind at some point, was it an attempt to make the name sound bio-inspired or simply a funny coincidence?

B.D.B.: In 2000, shortly after I became a professor, Ghent University decided to stop the proliferation of terms such as laboratory, seminar, center, institute, often without a clear difference in meaning, and restricted the free use to the term research unit. I grasped the opportunity to create my own research unit. It took a while to come up with a proper name, after listing the key terms I wanted to appear in it. Playing a bit around with initials, I came up with Research Unit KERMIT, the latter standing for Knowledge Extraction, Representation and Management using Intelligent Techniques. Of course, the coincidence with the name of the popular Muppet Show host (the frog KERMIT) was welcome. It surely helped to spread the brand recognition. At the same time, I created the well-known logo



including multi-layered hints to logic, fuzzy set theory, graph theory, neural networks, and so on. This year, we are celebrating the Porcelain Jubilee of KERMIT. The research unit has been highly successful, with three young professors joining in recent years, numerous publications, close to 80 grad-

uated PhD students, and visitors from several dozens of countries.

R.PF: Congratulations on the porcelain jubilee milestone! After having had been part of this fabulous team for about five years, I can only hope for many more to come. Interestingly, according to its website, KERMIT started “with two men and a dog”. Assuming the dog to be a poetic license, who were the men forming the team back then?

B.D.B.: Two men and a dog is a figure of speech for barely nobody. At the same time as I took up my professor position, there was also a brilliant mathematics student, Kim Cao-Van, who had just obtained a grant for pursuing doctoral studies under my supervision. Together with my friend Hans De Meyer, I also continued co-supervising Helga Naessens, a teaching and research assistant at my former department. There was nobody to support me in my teaching tasks in the very beginning.

R.PF: KERMIT currently employs around 25 members; does it not feel frightening how big you have become? How does it feel leading such a big team?



B.D.B.: KERMIT has indeed grown a lot, in particular over the past five years, and is now home to four professors, a few postdocs, about 20 PhD students in-house and a similar number of PhD students being co-supervised at other research units, departments and faculties at Ghent University, or at foreign universities. I enjoy being busy, it keeps me young and agile. Together with the PhD students I get to study new topics, explore new directions and contribute to new fields of research (such as the study of Cellular Automata over the past years).

R.PF: And this number does not include all your international collaborators! You maintain active discussions with people from Algeria, China, Cuba, Japan, Poland and Spain, just to name a few. What are the main reasons for you to search for and sustain all these collaborations?

B.D.B.: Indeed, I have always tried to sustain my own activities next to those with my PhD students. The variation between supervising PhD students and working with experienced people is welcome. The main reasons for doing this are my broad research interests, the opportunity to get to learn other cultures from the inside and, above all, make friends for life all over the world. I can safely say that most of my collaborators have become very good friends, such as Humberto Bustince. At moments like this, I am thinking of the

closest friend-scientist to my family, the well-known Janos Fodor, whose passing away has been very tough for me.

R.PF: It was indeed a big loss. You once told me you used to spend some good time in Hungary with your friend Janos. You even learned how to count up to ten in Hungarian, right? Actually, in how many different languages do you know how to count?

B.D.B.: That is a difficult question. Probably there are only a few languages in which I can count up to the number of languages in which I can count up to ten, to answer in a cryptic way. Flemish people, due to belonging to a small population and being surrounded by bigger countries, have always been keen on studying languages, in order to play a key role in international trade and business. Although at times this was a bare necessity for survival, this behavior has become an essential part of our culture. We listen to music in numerous languages and watch movies from all over the world (obviously, without dubbing). And we can hardly imagine going on holidays visiting a country without being able to say a few sentences in the local language. In my case, not surprisingly for a mathematician, this includes being able to count. You would be surprised how far you can get with basic numbers in a foreign language!



R.PF: Interesting! This breaks the ice for asking an off-work question. As a true Belgian, you love cycling (both practicing and following the classic races). You try to find some time for watching good sci-fi movies and are some kind of a music connoisseur (I think some of your friends even called you 'De Beats' back in the time). Aside of the obvious answer 'spending time with your lovely wife and children', can you tell us some other things you love doing in your free time?

B.D.B.: Indeed, we are a cycling nation. When the weather and my duties permit, I go to university by bike, and I love watching the classic races such as Strade Bianche, Paris-Roubaix and, above all, the Tour of Flanders. I still remember the whole nation going crazy in the late sixties and early seventies when Eddy Merckx (the Cannibal) was winning race after race (I was still in kindergarten then). I am also a movie and music lover with an eclectic taste (not really including sci-fi, your source was misinformed). My wife sings and our three kids all master an instrument (piano and saxophone), which brings joy to life. I hardly have free time, but I often try to combine late-night work with my passion for wine.

R.PF: Let us talk now a little bit about the EUSFLAT society,

in particular, and the fuzzy sets community, in general. Do you feel there has been a change in this community since its very beginnings?



B.D.B.: Sure, generations come and go, but luckily the overall friendly spirit has remained. I am familiar with many other scientific communities, and I can safely say that EUSFLAT is the most pleasant of all. It is also important that the European fuzzy community tries to uphold the main ideas of Lotfi Zadeh. On the other hand, I am sometimes surprised that some teams continue along the same lines for decades. That would be too boring for me. On the positive side, I see quite a few young researchers with high potential lurking around the corner, such as you, so the future for the community is bright.

R.PF: Are we moving in the right direction? How do you envision the future of the society?

B.D.B.: I will refer to the entire fuzzy society now, not EUSFLAT in particular. To my regret, my answer to your question is "Definitely not". We are witnessing a tsunami of pointless generalizations of fuzzy sets that have lost all connection with Zadeh's original ideas and of which the sole aim seems to be to generate superfluous publications. Over a couple of good Belgian beers, the two of us would surely be able to come up with the next five levels of ridiculousity. What about "double soft complex hesitant Fermatian fuzzy sets" for a start? Seriously, we have to return to the original ideas, focusing on semantics and elicibility. The current revival of the interest in explainability offers opportunities.





To me, fuzzy set theory rather provides a way of thinking (accepting that notions come in many shades and rather are a matter of degree) than practical tools as the field of machine learning does. After all, the alleged applications the community likes to brag about date back to the last century. Ninety-five percent of applications rely on five percent of theory, and even that is quite shaky when I think of our current understanding of Mamdani-Assilian models. New waves of applications seem to reside in the field of decision making, often being blind for the body of knowledge that has been accumulated by that field over the past years, and paying little attention to semantics. Also here, the motto seems to be “the more complex, the better”. This evolution often makes me sad, seeing time and talent of the scarce mathematicians we still have being wasted.

R.PF: Do you think time will lead to some basic notions of fuzzy set theory being taught at high school level? If you were in charge of preparing a subject on the topic, could you briefly anticipate how would it look like?

B.D.B.: I think the mathematics education in elementary and high school worldwide faces far bigger challenges than the possible introduction of fuzzy sets. Reform after reform, mathematics has been reduced to a bunch of tricks students need to master to be able to temporarily solve a preset list of problems. Mathematics is no longer taught as a language. Students are no longer attracted by the subject, leading to fewer university enrollments, fewer real math teachers, again less interest, a vicious cycle that seems hard to brake. But if I were to prepare such material, I would definitely start from real-world examples focusing on the three semantics of fuzzy sets (degree of similarity, uncertainty or preference).



R.PF: You are co-editor-in-chief of Fuzzy Sets and Systems, one of the main journals of the fuzzy sets society. Do you have any special recommendation for a student that is aiming at submitting his/her first paper? And, an additional question for the same price, do you have some recommendations for more experienced researchers?

B.D.B.: One recommendation, which even applies to some experienced researchers: whatever you write, have the potential reader in mind and reflect whether you would read it all to the end if you would see it for the first time yourself. Introductions that do not frame a problem with respect to literature, or flood the reader by bulk citations, are not helpful. Pages of definitions without discussion, interpretation or examples are not exciting! And above all, read, read, and read, before you write.

R.PF: You were one of the driving forces promoting the EUSFLAT student grant program, from which myself among many other students have benefited through the years. How do you feel about the state of the program? Do you think a similar program for researchers from developing countries and/or early career researchers should be funded?



B.D.B.: I am still proud having launched the student grant program years ago, and to see it still functioning while respecting the same rules. Many other societies envy us. The younger generation is the future, so we should invest in it. At present, I am exploring how we could set up a similar program for African researchers, as they still have very few chances.

R.PF: This student grant program is only one of many contributions to the EUSFLAT society in which you have been involved through many years. What do you see as your main / favorite contribution to the EUSFLAT society? And to the fuzzy sets community?

B.D.B.: That is a question that is hard to answer with modesty and should probably be posed to others. After all, I am just passing by in this world and time will tell whether it was relevant or not. I am happy my wife and I have contributed three wonderful specimens to this planet and to have been able to have guided numerous young people in their search, that should suffice.

R.PF: Perhaps I can speak up in the name of the (not anymore so) young people you have guided and thank you greatly for your many contributions to the EUSFLAT society and, more personally, for being a key contributor to the beautiful time I spent in Ghent. As a concluding comment, we all

know you have been involved in the organization of many conferences, but in 2021 you are going to face your biggest challenge with EUSFLAT 2021. I would like to end this interview by wishing you a lot of success and by asking you to do some shameless publicity of the event. Thank you very much for sharing your experience with us!

B.D.B.: Actually, we are not just organizing EUSFLAT 2021. In the week July 5-9, 2021, Guy De Tré, Chris Cornelis and myself are organizing the 2021 Multi-Conference on Fuzzy and Rough Sets, collocating the Nineteenth International Fuzzy Systems Association World Congress (IFSAC), the Fourteenth International Conference on Flexible Query Answering Systems (FQAS), the Twelfth Conference of the European Society for Fuzzy Logic and Technology (EUSFLAT), the Eleventh International Summer School on Aggregation Operators (AGOP) and the 2021 International Joint Conference on Rough Sets (IJCRS). The running theme of the multi-conference is the age of sustainability, referring to the way the conference will be organized, the themes in society that should have our priority and the sometimes poor state the field is in (see my earlier comments on some meaningless directions in fuzzy set theory). The year 2021 will also be the Centennial Commemoration of Lotfi Zadeh's birth. Moreover, the conference will be dedicated to Etienne Kerre, the local fuzzy pioneer at Ghent University.

Thank you for this interview!

