Logic and Love

Nick Rossiter Talk to Rotary Club of Hexham, 9 May 2022

Workshop Title

- At Universal Logic (UNILOG) conference
 - 7th World Congress and School on Universal Logic
 - One of a number of activities at conference
- Held in Crete, April 2022
 - School: April 1-5 / Congress: April 6-11
 - Orthodox Academy of Crete, Kolymvari

Past Meetings



Next meeting: 2025 Peru --Machu Picchu

What's it all mean?

- Logic is reasoning
- It doesn't have to be on the computer
 - Natural language is used for reasoning
 - Commonplace in law
- But it is everywhere in computing today
 - And in mathematics

Philosophical Background

- Logic is inherent in philosophy:
 - Perceptions of reality
 - Right back to Aristotle and Plato
 - Categorical logic/identity
- Computing Science
 - Also studies how to represent reality via mathematics
- So natural convergence between the two subjects
- Main disciplines at UNILOG:
 - mathematics
 - computing science
 - philosophy

Boolean (Classical) Logic

- Basis of most computerised logical systems today
- Developed by George Boole
 - born November 2, 1815, Lincoln, Lincolnshire, England
 - died December 8, 1864, Ballintemple, County Cork, Ireland
- Views the world as sets of data with operations AND, OR, NOT

Examples – Venn Diagrams (Boolean Logic)



Prevalence of Boolean Logic today

- Used in relational databases
 - Idea developed by Englishman Edgar 'Ted' Codd (1923, Portland, Dorset 2003, Florida) at IBM in San Jose, California, in 1970
- First Order Predicate Calculus (Logic)
 - Target with filters applied in search expression, simple objects
 - SQL, Access, MySQL
- Ted Codd is to databases as Alan Turing is to programmable machine architecture (1936)
- Dominates commercial data storage and retrieval
 - Banking, insurance, transactions, cloud, directories, catalogues
- Forecast market of \$18.8 billion by 2026 with CAGR 38.4%
- I taught databases at Newcastle and Northumbria Universities from 1974-2010

Conference Location



Orthodox Academy of Crete

Alongside Gonia Odigitria Monastery



At Kolymvari, Rodopos Peninsula



Near Chania

View of Lefka Ori Mountains



Highest point Pachnes 2453m asl

So what's the purpose?

- No papers on classical logic
 - Research conference aimed at new techniques
- So what's the matter with classical logic
 - It's certainly simple, easy to implement for high performance and works well in many situations
- But as logic moves into more challenging areas, need to handle more subtlety and complexity with high security

Flavour of Conference

- •Logic prize (won by Brazil)
- •Keynote lectures on various types of logic
- •General Session every day mainstream papers, including one of mine on categorical logic
- •Workshops to address specialist/ more speculative areas

Workshops

•Research areas in logic

- -Proof and Styles of Reasoning Across Times and Cultures
- -Axiomatic Method
- -Reasoning in Text
- -Belief Revision
- -Refutation
- -Analogy

Speculative areas

- -The Logic of Social Practice
- -Logic and Politics
- -Logic in Defective Science
- -Lewis Carroll's Logic*
- -Logic and Love**

Logic and Structure Hybrid Logic and Applications Oneness Argumentation Rough set

* His real name was Charles Lutwidge Dodgson and of course he was famous for the wonderful Alice books and the Hunting of the Snark. But he was an accomplished logician developing truth trees and could have been a great one if he had managed to publish the last parts of a treatise before his death. The nonsense in his tales relates to his love of absurd logical situations such as the mad tea party!

** My second paper was in this workshop

One Problem – Double Negatives

- Expressive Natural Language
- He ain't got no money
 - Slang, double negation used for emphasis
 - Strictly, means he does have some money
 - But the intent is that he hasn't got any money at all
- Nick is not in the list of failures for an exam
 - So is Nick in the list of successes?
 - Or is there a third way?
- She does not find him unattractive
 - Subtle, more nuanced than:
 - She finds him attractive

There is no Third Way

- Tertium non datur (Latin, but after Aristotle)
- In classical logic, closed world
 - NOT NOT A is A
 - A double negative is true
- Does not always match reality
 - Nick may not be on the failure list but is not necessarily on the success list
 - Could be referred, absent, invalid entry

Gender Issues

- Fred is NOT a man
- Doesn't mean that
 - Fred is a woman
- There is a third way:
 - Fred might be (besides male, female):
 - transgender, gender neutral, non-binary, agender, pangender, genderqueer, two-spirit, third gender, and all, none or a combination of these

Constructive Logic

- Proofs are through following connections (premises, propositions) along a chain of reasoning
 - If you cannot construct your target, then answer is false
 - If you can construct your target, then answer is true
- Analogous to legal reasoning
- After Aristotle's topos theory (Organon) and modern theory of categories (Eilenberg & MacLane 1945)
- There is a third way as context is open

Applications

- Intuitionistic Logic (Heyting 1930)
 - Intuition, mathematically, is making all the connections: it is not an instinctive approach
 - Used in proofs of complex systems
- Blockchain (Haber & Stornetta 1991; Satoshi Nakamoto 2008 'Mr Bitcoin')
 - Cryptocurrencies
 - Bitcoin mining
 - Complex trade bills (e.g. lading)
 - Cybersecurity
 - Payment systems
- Implementations in Haskell and now many other programming languages
- Problem
 - Computationally expensive but machines are very fast now
- Market in 2026 forecast to be \$67.4 billion, at a CAGR of 68.4%
- My research area: applications of category theory, over 250 papers published 1990-present

Logic and Music

- Last UNILOG (2018) at Vichy held this workshop
- We did make progress
 - Music has a technical notation
 - Performances can be handled by process logic
 - Even modelling the brain lateralization
- Music is a collaborative activity involving communication and expression



fingers

bow

Process-thought

Logic and Love

- So did we make comparable progress here
- No!
- Love is a step too far in current logic
- It should be possible as everything reduces to physics and chemistry
- But we do not have the tools at present in the biology sphere, such as Newton's laws of thermodynamics and Einstein's relativity for physics

Some ideas

- Certainly not classical logic
- Intuitionistic logic, with its third way, offers more scope for expressing subtle concepts
- Chinese philosophers (e.g. Confucius) were regularly cited
- I explored
 - mass+energy in the context of space and time (cosmos)
 - Brain lateralization in context of emotion (psychology)

Tension between Pleasure and Anxiety



Process-thought

Doesn't mean the workshop's a failure

- Areas of shortcomings in logic identified
- Encourage more exploration of:
 - Intuitionistic logic
 - Cosmos
 - Brain lateralization
 - Appropriate chemical structures
 - The philosophy of love

Coffee Time



Trip to Agia Traida Monastery near Chania with UNILOG delegates



Workshop Logic and Love



Crete Music and Dancing

Taverna Paradise Kolymvari 10 Apr 2022



Woodchat Shrike



Griffon Vulture



The End



Chania – Venetian Harbour Wall