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GEORGE BOOLE, GLOBAL HERO

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Talk at the opening of the *The Life and Legacy of George Boole* exhibition in Lincoln, 16 July 2015.

I am privileged to take part in this celebration and I am honored to represent the London Mathematical Society.

The LMS was founded 150 years ago by Augustus De Morgan, a colleague and close friend of George Boole, just a year after Boole's untimely death. The Society continues the work started by mathematicians of George Boole's circle.

Some people say that mathematicians are remote from everyday life.

George Boole was not.

Here, in Lincoln, he taught at the Mechanics Institute, fought for the improvement of working conditions of shop workers, founded a building society.

His famous book *An Investigation of the Laws of Thought* was very down-to-earth, it was a textbook of practical thinking. It was written for humans, not for machines—after all, computers remained non-existent for another century.

This is his famous definition of the *universe of discourse*—a concept that you will immediately recognise as obvious, everyone-knows-it kind of things—but which was new, fresh, and perhaps paradoxical in Boole's time.

> In every discourse, whether of the mind conversing with its own thoughts, or of the individual in his intercourse with others, there is an assumed or expressed limit within which the subjects of its operation are confined.
>
> The most unfettered discourse is that in which the words we use are understood in the widest possible application, and for them the limits

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> of discourse are co-extensive with those of the universe itself.
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> But more usually we confine ourselves to a less spacious field.
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> Sometimes, in discoursing of men we imply (without expressing the limitation) that it is of men only under certain circumstances and conditions that we speak, as of civilized men, or of men in the vigour of life, or of men under some other condition or relation.
>
> Now, whatever may be the extent of the field within which all the objects of our discourse are found, that field may properly be termed the universe of discourse.

In short:

– The laws of thought are *global*; but
– they are applied *locally*, for example, at a board meeting of a building society.

Please notice George Boole's words:

> we imply (without expressing the limitation) ...

This is his warning against undeclared assumptions that can poison the discourse, his warning against

– hidden bias,
– hidden prejudice,
– hidden phobia,
– hidden hatred.

Boole's time was the era of tectonic shifts in technology, in economy, and in social life.

The need for practical logic for everyday use, logic freed from medieval scholasticism, logic accessible to everyman—was in the air of the epoch.

The great contemporary of George Boole, Abraham Lincoln, used in his political writings and speeches the implicit logic of the Euclidean geometry:

> One would start with confidence that he could convince any sane child that the simpler propositions of Euclid are true; but, nevertheless, he would fail, utterly, with one who should deny the definitions and axioms.

> **The principles of Jefferson are the definitions and axioms of free society.**
>
> And yet they are denied, and evaded, with no small show of success. One dashingly calls them 'glittering generalities'; another bluntly calls them 'self-evident lies'; and still others insidiously argue that they apply only 'to superior races'.

From these two quotes, it is hard to avoid the impression that both Boole and Lincoln were thinking in terms of what we now call "*human rights*".

It is also difficult to avoid the feeling that for Boole and Lincoln, Logic was the Logic for the Masses; it was

– Logic for Personal Empowerment,
– Logic for Social Advancement,
– Logic for Liberation.

Abraham Lincoln re-used mathematical thinking of classical geometry dated 2 millennia back in time.

But George Boole took an audacious step into the future. He created a new logic and a new mathematical symbolism which supported it.

He extracted the most basic and fundamental laws of thought, so simple that they are now used by computers. Everyone in this room has a mobile phone; in every mobile phone, microchips contain millions of logical gates carrying out millions of Boolean operations per second.

By discovering algebra of thought—now implemented in computers and electronic devices all around us—Boole changed the course of human civilization.

George Boole is a global hero.

But he wouldn't become a global hero, if he was not a *local hero* here—in Lincoln.

His life and work are the best justification of the dictum:

Think globally—act locally!

Acknowledgements

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