What Does Gödel’s Theorem Mean After 70 Years?

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Review of the Session 2000-2001

PRIZE LECTURES

The 30th Gunning Victoria Jubilee Prize Lecture
5 February 2001 - Professor Angus Macintyre

What Does Gödel’s Theorem Mean After 70 Years?

Angus Macintyre is one of the main exponents of model theory, particularly in its interaction with algebra, number theory and algebraic geometry. Model theory is a branch of mathematical logic which has developed during the 20th century into an independent and fundamental area of mathematics. The leaders of this development were Alfred Tarski (1901-1983) and Abraham Robinson (1918-1974); Angus Macintyre continues the line, indeed he succeeded Abraham Robinson at Yale where he worked for 12 years. His professorial career continued for a further 12 years at Oxford and more recently at the University of Edinburgh. Over the last seven years he has played an important leadership role across the mathematical spectrum as Scientific Director of the International Centre for Mathematical Sciences.

Because of its technical nature, its volume and diversity, it is impossible to review his scientific work briefly. Overall, his work has extended enormously the areas where model theory is used. Recent publications have involved such varied subjects as neural nets, the cohomology of algebraic varieties and Schanuel’s conjecture on transcendental numbers. His erudition and enjoyment of life are additional factors that attract logicians worldwide to collaborate with him.

Professor Macintyre reminded the audience that Gödel’s Incompleteness Theorem was published in 1931, when the author was 25. He noted that probably no other theorem of pure mathematics has been more written about in popular literature, and the extremes of its misrepresentation are mind-boggling.

Professor Macintyre felt that, contrary to a widespread impression, Gödel’s proof is not difficult. It has an unrivalled ratio of general interest to mathematical difficulty. Gödel apparently agreed with Kreisel’s opinion that others would probably have got to the same result soon, but were hampered by ideology. As it turned out, Gödel’s paper was quickly understood and improved, culminating in Turing’s definition of effective calculability.

What Gödel showed was that putatively universal formal systems for mathematics (anachronistically, idealised mechanical devices for generating theorems) do not have the power to generate simple theorems about themselves. The generality of his method is such as to leave a permanent gulf in principle between the informal notion of mathematical truth and the precise formal notion of mechanical output from a black box. At various points in the last seventy years, Gödel’s Theorem has figured prominently in...
discussions of creativity and consciousness, (notably in the controversial work of Sir Roger Penrose).

The “universal” system singled out for mention by Gödel in 1931 was “Principia Mathematica” of Russell and Whitehead, a system almost obsolete at that time. Subsequently Gödel obtained deep results about the deductive power of specific modern systems such as ZFC (Zermel-Fraenkel with Choice), here revealing the possibility that problems which had resisted solution were in fact independent of the only axioms about which there is widespread agreement (a possibility amply confirmed by the last forty years of work on ZFC). Gödel proposed a scheme for finding new axioms at least for this part of mathematics.

Despite the extensive popular literature, and the undoubted beauty of Gödel’s proof, Professor Macintyre observed that the mathematical enterprise seems little affected. No objective of mainstream mathematics has been shown to be out of reach of current axioms due to the Gödel phenomenon. Though we know that the phenomenon affects even equations in number theory, it is not known to bear at all on the “high theory” of modern arithmetic algebraic geometry, which has yielded a series of spectacular results (notably the Taniyama-Shimura Conjecture and Fermat’s Last Theorem). Gödel’s theorem was the first about some prima facie reasonable model of theorem proving, and it revealed glaring oversights in the foundational positions most prominent around 1900. Professor Macintyre concluded that it is a memorable example, in the tradition of Einstein, of what can be achieved by a combination of philosophical analysis and undemanding mathematics. It has encouraged the growth of mathematical logic, nowadays useful in more traditional areas of mathematics. But there is no reason, for now, for it to affect the practice of mathematics.

In the ensuing discussion Professor Macintyre was asked whether the everyday reasoning by mathematicians maps onto a logical system. He felt that in general it does not. A lot of careful work has been carried out on the basis of set theory – but it is rarely used! Referring to the Russell paradox, he was challenged to explain who shaves the barber and to discuss the issue of the set of all sets. His brief answer was that there is not any set of all sets. Finally the difference between provability and truth was raised. He responded that provability can be defined but truth is more difficult. Gödel believed there is a mathematical reality and that this is not a paradox.

Professor Allan Sinclair proposed the vote of thanks, noting the highly impressive character of the exposition - notwithstanding the failure to define truth! He concluded that the audience was indebted for such an excellent lecture and thanked Professor Macintyre for providing such a good example to the many young people present.
Dr Adrienne Scullion has been a lecturer in the Department of Theatre, Film and Television Studies at the University of Glasgow since 1996, an appointment which followed her term as British Academy Postgraduate Fellow. It is indicative of the renewed vitality of Scottish theatre over the past decade that it has attracted scholarly interest in its dramatic literature, in its institutions and in a revision of its history. In each of these areas, Dr Scullion has been a pioneer.

She has written seminal essays on drama and theatre in Scotland in the eighteenth and nineteenth centuries, on contemporary dramatists (with a focus on women playwrights) and on the impact of social and political change on theatrical culture. Her work extends to radio, film, and television. The quality of her research and writing has helped to promote Scottish theatre and drama as important subjects for international, as well as national, scholars.

But Dr Scullion’s commitment to Scottish theatre is not confined to the academy. She is an active member of the boards of management of a number of companies, ranging from the Citizens’ Theatre to the East Glasgow Youth Theatre, and is an adviser in Performing Arts to the Scottish Arts Council.

She has promoted the study of theatre, and specifically theatre in Scotland, in Secondary Schools by her work for the Scottish Consultative Council on the Curriculum’s Review of Scottish Culture in the Curriculum, and by her involvement in the curriculum design and implementation of Higher and Advanced Higher Drama.

Dr Adrienne Scullion’s contribution to professional theatre in Scotland, to theatrical education in Scotland and to theatrical scholarship, both nationally and internationally, has led the Royal Society of Edinburgh to award her the BP Prize Lectureship in the Humanities in 2000.

Dr Scullion began by saying that the creation and implementation of the devolved Scottish parliament marked a radical reorganisation and recreation of British political structures. She said devolution would affect how we create, imagine and represent Scotland, and the Holyrood Government would result in shifts in how we understand and participate in the dynamic processes of Scottish national identity.
Her lecture argued that, if representations and images and identities are evolving within modern Scottish culture, then so too must critical language, critical rhetoric and discourse.

This argument was contextualised in relation to the ideas and engagements with national identity within modern critical literature – and, in particular, within Scottish critical literature. In recent years the wider critical literature around the idea of identity – and in particular national identity – has shifted. It is commonly argued that the re-emergence of political and of ethnic nationalism in Europe and beyond has led to a reconsideration of issues of identity, and an interrogation of critical orthodoxies. The ideas of nations as ‘imagined communities’ and of identity as fragmentary and ‘fuzzy’ matter when considering the evolution of identity politics and its impact on our critical vocabulary. Dr Scullion’s lecture questioned how these developments are tested in relation to interpretations of gender and the idea of ‘national’ within Scottish cultural criticism.

The lecturer then considered issues of identity and representation in the drama that emerged from that system. Because of the orthodoxies of Scottish cultural practices and criticism, when artists challenge the conventions of narrative or of gender representation, they also challenge the conventions of representing and responding to the nation. Dr Scullion proceeded to discuss this through close analysis of Zinnie Harris’ Further than the Furthest Thing, Sue Glover’s Shetland Saga and Nicola McCartney’s Home (all 2000).

All three plays offered different versions of community – empire, nation, island, family – and different dramas of inclusion and exclusion. Analysis focused on language, on the recurrent motif of the ‘return of the native’ and on the role of external and unpredictable forces in the creation of ‘belonging’. The lecturer argued that the context of devolution affords the opportunity to rethink the rigid lines of identity and move towards smaller and more flexible connections.

These plays met the challenges of a devolved Scotland by adopting a dramaturgy, by telling stories that are both international and outward looking and essentially and immediately committed to work within and about Scottish society. It was political devolution and the creation of the new Scottish Parliament that insisted that these two dynamics can no longer be interpreted as mutually exclusive.

The lecturer concluded by asking where next for cultural criticism in Scotland. If it was agreed that devolution matters in terms of representation and that devolution might just impact on the type of art being made; and if it was agreed that feminist art and
criticism might unsettle representational and critical orthodoxies, then we should anticipate that devolution will result in shifts in the criticism of and for Scotland.

Following a brief discussion session, Professor Jan MacDonald, Professor of Drama from the Department of Theatre, Film and Television Studies at the University of Glasgow, offered a vote of thanks for an address well grounded in Scholarship and for the focusing of issues which helped the hearers to understand themselves. She also thanked the Lecturer’s two assistants, whose contribution in reading extracts from scripts, added to the appreciation of the issues being addressed.
Prize Lectures

4th Henry Duncan Prize Lecture
Monday 29th October 2001
Professor David McCrone

Stateless Nations in the 21st Century. The Case of Scotland

David McCrone has long been the pre-eminent sociologist of Scotland. For many years, he has conducted and published influential work on social formations and social change, on politics and voting behaviour and on urban development in Scotland. To this formidable range, he added groundbreaking work on the use and abuse of heritage and cultural tradition. Then in 1992 he published Understanding Scotland, the definitive text on the making of Scottish society over the last century and a half. A second and revised edition has just been published.

Central to all this work has been his abiding concern with the anomalous nature of Scotland as a ‘stateless nation’. To understand this anomaly, he undertook over many years the comparative study of nationalisms and their social bases, which culminated in the publication in 2000 of his magisterial study, The Sociology of Nationalism. He was the moving spirit behind the successful application to the Leverhulme Trust for a £1M programme grant to study the relationship of national identity and devolutionary processes in the U.K., a programme which he now coordinates and directs, inspiring and shepherding nine separate projects, run by scholars from five institutions, into a surprisingly coherent form. He played a major role in devising and advising on procedures for the Scottish Parliament. At the University of Edinburgh, he is Professor of Sociology and co-Director of the Institute for Governance, a scholar of international renown, and one of Scotland’s most distinguished social scientists.

Professor McCrone started by noting that it is one of the enduring puzzles of the social sciences that while Scotland had a claim to have played a major intellectual role in founding the discipline of sociology – at least what we might call its proto-sociology – it has taken until the 21st century for it to come to terms with the Scottish case.

The general tenor of his lecture was to use the Scottish case as an arena, a test-bed, for shifts in the modern world, and to set it up as a case of a stateless nation which illuminates processes which require the social sciences, and sociology in particular, to refocus how it sees the world in quite a fundamental way. Hence, looking at Scotland is not some kind of parochial endeavour, but has much wider implications for how we do social science in the modern world.

Doing sociology frequently involves a Scottish way of think-
ing: a concern with observation, causation, experimentation, connecting with and not being embarrassed about the ‘real’ world. A Scottish way of doing sociology would deal in the language of universals while doing so in the grammar of the particular, comparing and contrasting social processes as they emerge and impact differentially in different territories, and at different scales.

There is something analytically valuable about studying small societies like Scotland. Desperate jibes about ‘parochialism’ are really far from the truth. Comparison, and the comparative method, so fundamental to human as well as natural sciences, is de rigueur because no one in their right senses thinks Scotland (or Ireland or Denmark, for that matter) are unique or universal.

There is another and crucial reason why Scotland has been resurrected as a suitable case for sociological treatment. The world of the so-called nation state is coming to an end, or at least, is being thoroughly problematised.

Just as a small boat is the first to sense changing tides and currents, so small societies confront social change most immediately, and have to react quickly or go under. Larger societies can hold out for longer but ultimately have to change, often with bad grace. Instead of being an odd, ill-fitting case, Professor McCrone concluded that Scotland should be moved to the centre of the social science dilemma about the autonomy and boundaries of societies.

In the subsequent discussion Professor McCrone was asked if there is something coercive about attaching the notion of nation to an “imagined community”? In replying he observed that civic nationalities do not necessarily carry coercion, unlike, say, ethnic groups. Overlapping nations exist, giving people more opportunity to choose where they fit.

Professor Tom Devine gave a vote of thanks, congratulating Professor McCrone on the award of his prize and the quality of his presentation. The clear delivery and cogent analysis was suitable for the audience, which ranged widely beyond social scientists. It was apparent that there is a body of academics thinking through where their subject stands and why the sociology of Scotland matters in the broader context of their discipline. He had provided the audience a strong basis for further discussion. He thanked Professor McCrone for an enlightening and stimulating lecture.