Nineteen Fifty-Eight: Information Technology and the Reconceptualisation of Creativity

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NINETEEN FIFTY-EIGHT WAS AN EXTRAORDINARY YEAR for innovations in the arts and in the sciences. This essay examines the ways in which those innovations were driven by developments in the formal theory of information. The developments in information theory facilitated the rapid growth of computational technologies. They also provided new foundations, and new explanatory ideals, for linguistics, for psychology, and for the human sciences more generally. They thereby put pressure on established conceptions of human creativity and culture. In the natural sciences and in mathematics there were logical results (from the philosophy of science and from metamathematics) that enabled this pressure to be used in generating a positive new conception of the way in which mathematical and scientific enterprises require an essentially cultural form of human creativity. The literary arts had no analogous results with which to operate. The pressure on established conceptions of human creativity was therefore felt by authors and critics in the form of an urgent anxiety which, as the concluding sections of this essay show, can be seen manifesting itself in the novels, plays, and critical disputes of the period. The links between formal theories of information and the conception of creativity are at their closest in the science of linguistics. It is there that the innovations of 1958 begin.

I

Noam Chomsky's 1959 review of B. F. Skinner's 1957 book *Verbal Behavior* would not have dealt such a devastating blow to Skinner's behaviourist

research programme had Chomsky's own 1957 work, *Syntactic Structures*, not shown that intellectual resources were then in place that allowed the cognitivist alternative to behaviourism to be pursued fruitfully. These new intellectual resources provided the foundations for Chomsky's project in linguistics and, then as now, they provided the foundations for cognitive psychology more generally. They were partly the result of research that was concerned with the pursuit of logical and technological innovations, but – as I aim to show here – they were also related closely to innovations in the arts.

On the logical and technological side, the new intellectual resources were those of information theory, as developed by Claude Shannon, and of computation theory, as developed by Alan Turing, John von Neumann, and others. On the artistic side, they arose from a reappraisal of modernist conceptions of individual creativity and of culture, and from a reappraisal of the relationship between these things and the inheritance of a tradition.

These two reappraisals were especially well represented in England, where their impact could be seen in the theatrical innovations of the English Stage Company (then newly founded at the Royal Court Theatre), could be felt in analytic philosophy (especially in those parts of it that took up themes from the later work of Wittgenstein), and could be discerned in several changes in society at large (especially in changing attitudes to politics, to protest, and to satire).

In what follows I give an account of some of the more prominent among these cultural developments, with a view to showing how they were related to the logical and technological developments with which they coincided. I hope thereby to show that the development of cognitivism in psychology and linguistics was part of a large-scale cultural renegotiation that took place at the end of the 1950s, with its epicentre in 1958.

It has been noted previously that there might be some story to be told about the relationship of linguistics to culture more broadly. Chomsky himself has often suggested that there were cultural factors, as well as scientific ones, that contributed to the reception of his proposals about generative grammar, but I am not here looking to culture in an attempt to identify the efficient cause for Chomsky's revolutionary influence on linguistics. My position is, rather, the contrary. The cultural developments that I shall be considering here took place over so condensed a timescale, and the developments in linguistics took place over so prolonged a period, that it cannot simply be the case that Chomsky's effect on linguistics reflected a prior cultural shift. The central ideas of Skinner's *Verbal Behavior*, of Chomsky's *Syntactic Structures*, and of

Chomsky's 1959 review of Skinner's book, were all conceived well
before any of those works came to publication. The central parts of
Skinner's discussion had had an influential life in mimeograph form
long before their eventual publication, and Skinner himself, in the
preface to his book, traces the gestation of his central ideas over a
period of more than twenty years. Chomsky, for his part, tells us that
his complaints against Skinner's project were a long-standing concern,
and that he 'actually wrote the review before the book was published'.
In contrast to the prolonged development of these ideas about language
and linguistics, the cultural and artistic developments that I shall be
reviewing here took place remarkably quickly.

They also ranged over a remarkably broad field: the year 1958 saw
innovations in social realist theatre, in nouvelle vague cinema, in
modal jazz, in poetry, in moral philosophy, in developmental psychol-
ogy, in sociology (especially in its relations to social psychology and to
anthropology), and in the scientific study of workplace organisation.
Only some of these innovations are discussed below, but all of them
exerted an influence on our perception of the individual and of indi-
vidual creativity. All took place in the year after the publication of
Chomsky's and Skinner's books and before the appearance of
Chomsky's review. What we seem to have had, then, is a widespread
cultural shift for which structuralist linguistics was the avant-garde.
This essay is an attempt to understand how such a thing could have
happened.

II

My claim that the literary and artistic developments of 1958 were
animated by the technical and scientific developments that character-
ised linguistics in this period is one that, as with any claim about
intimate connections between distinct cultural phenomena, requires
us to strike a balance. In order to understand the terms in which
this claim is stated, we must understand there to be a distinction
between the two sorts of cultural phenomena that are in question.
But the claim itself threatens to undermine that distinction, by telling
us that the events on either side of it were not really all that distinct.
Nowadays, the drawing and collapsing of such distinctions is so
much a part of our intellectual stock-in-trade that we are all of us
adept at striking the requisite balance. To us it seems quite natural
to assume, at least as a working hypothesis, that the mutual influ-
ences between scientific and artistic intellectual developments may
have been sufficiently strong for it to be explanatorily revealing to

view each in the context of the other. We routinely assume such things without thereby denying that each development had a logic and a life of its own. But such hypotheses did not always enjoy their current levels of prima facie plausibility. The sociological understanding of science on which this plausibility depends was itself a product of the intellectual developments that were in contention in the years that concern us here.

That understanding had begun to emerge with Robert Merton's work in the late 1930s, and continued to be developed in articles that he published throughout the 1940s and 1950s. In a rather piecemeal fashion, this work applied the methods of sociology to the social practices and norms of scientists. By the end of the 1950s Merton was beginning to regard this piecemeal approach as unduly tentative. He begins his August 1957 presidential address to the American Sociological Society – diagnosing the prestige attached to scientific priority – by suggesting that the theorists of the future 'will doubtless find it strange that so few sociologists (and historians) of the twentieth century could bring themselves, in their work, to treat science as one of the great social institutions of the time'.

Although Merton may have been right to say that, among the American sociologists of 1957, there were rather few theorists who were treating science as a social institution, he was certainly premature in predicting that this attitude would come to seem distinctive of sociologists (and historians) for the whole of the twentieth century. In fact, it turned out that those few of Merton's contemporaries who were treating science as a social institution were doing so in a way that would prove to be extraordinarily influential. It was at the time when Merton was lamenting the lack of sociological treatments of science, and especially in 1958 – the year following Merton's address – that Thomas Kuhn was most concertedly at work in articulating the philosophical picture that emerges when one regards science in the sociologically informed way that Merton was advocating. It was in that same year that Michael Polanyi's *Personal Knowledge* was published, providing what continues to be the most thoroughly elaborated account in which the progress of science is understood as a social phenomenon, and so in ways that differ markedly from the positivistic account that had, until then, been the received view. And it was in these same years that Sir Charles Snow first presented the picture of scientific and literary culture that his 1959 Rede lecture, on 'The Two Cultures and The Scientific Revolution', would establish as a locus of famously high-profile controversy.

III

The most frequently noted feature of the cultural background against which each of these works was received is the postwar emergence of the United States as a centre of artistic and scientific activity, with its concomitant questions about the ways in which the American sciences and arts differed from their European predecessors. As Chomsky has remarked, in a relatively recent interview:

> In the 1950s, after World War II, there was a rather unusual period in the United States. The US was the richest country in the world before the war and it had been for a long time, but intellectually and culturally it was kind of backwards. If you wanted to study physics you went to Germany, if you wanted to study philosophy you went to England, if you wanted to be a writer or an artist, France. Being in the United States was like being in central Idaho today. It was not the intellectual and cultural center by any means. It was also not the major political force; it was in its own region but not a global player, like Britain, let's say. But that all changed with World War II . . . the US emerged far richer than it had been . . . And there was a period of triumphalism about what those bad old Europeans weren't doing properly and we had to tell them: now *we* are going to run the world intellectually as well, culturally as well.[1]

By 1958 this cultural emergence of the US seemed, rather suddenly, to be a completed action rather than an ongoing process. This was particularly clear in the popular arts, where America's emergence had been most conspicuous. Nineteen fifty-eight was the year in which Jerry Lee Lewis abandoned touring and was blacklisted from radio (after it emerged that he had married his 13-year-old cousin in December of the previous year). It was the year in which Marilyn Monroe made her last successful movie (*Some Like It Hot*). And it was the year in which Elvis Presley's most productive run of filming and recording was stayed, first by his being conscripted to the military (in March), and then by the death of his mother (in August). In the high arts too, the first phase of the transatlantic cultural relocation seemed to have drawn rather abruptly to a close: Jackson Pollock was dead – he had died in 1956 – and Ezra Pound no longer looked like a force to be reckoned with: his literary essays being complete enough to have been collected in 1954, he was enough of a spent force in

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[1] J. Virués-Ortega, 'The Case against B. F. Skinner 45 Years Later: An Encounter with N. Chomsky', *Behavior Analyst*, 29/2 (2006) p. 243.

1958 to be discharged from St Elizabeth's hospital in the April of that year.

In England, the attempts of poetry to find a postwar voice seemed, equally abruptly, to have stalled. Robert Conquest's 1956 anthology, *New Lines* – like D. J. Enright's 1955 *Poets of the 1950s* – was taken at the time of its publication to contain the first pronouncements of an emerging new movement in English poetry but, as Conquest's introduction to his volume explains, it was only the rejection of past principles that gave his anthology its unity, not any positive agenda shared by the poets whose work was collected there:

> It will be seen at once that these poets do not have as much in common as they would if they were a group of doctrine-saddled writers forming a definite school complete with programme and rules. What they have in common is perhaps, at its lowest, little more than a negative determination to avoid bad principles.[2]

None of the members of the movement represented in Conquest's and Enright's anthologies identified very strongly with it. It was outsiders who dubbed it 'The Movement', and only they who gave it a capital M. By 1958 – with Thom Gunn having relocated to San Francisco, with Kingsley Amis in Princeton (writing mainly about science fiction), with Donald Davie looking more like a critic than a poet, and with Philip Larkin writing little and publishing less – only an optimistic onlooker would have thought that poetry in England was moving, as Conquest had claimed, in the direction of 'a genuine and healthy poetry of the new period'.[3]

The Second World War and the subsequent emergence of the US may have been the most prominent causes of the prevailing sense that we had entered a new period, with new challenges of a sort that were causing English poetry to stall, but there was also a more abstract group of problems, unrelated to the war, that raised a more foundational challenge, not only for poetry, but for the attempt to limn the modern mind more generally. These problems were not only holding up modern poetry, they were consanguineous with those that Elizabeth Anscombe told us ought to have been holding up moral philosophy. At the beginning of her 1958 article 'Modern Moral Philosophy' she was characteristically adamant in declaring that 'it is not profitable for us at present to do moral philosophy; that

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[2] Robert Conquest, *New Lines* (London 1956) p. xv.
[3] Ibid., p. xi.

should be laid aside at any rate until we have an adequate philosophy of psychology, in which we are conspicuously lacking'.[4] In previous years Anscombe's declaration that philosophers had failed to accurately picture human psychology might have rung in poets' ears as a call to arms. In 1958 the result was anxiety, and not merely artistic concern, because the task of finding this 'conspicuously lacking' psychological picture was now being approached – with radically unfamiliar tools, newly appropriated from the still nascent discipline of communication theory – by Chomsky in psycholinguistics, and by Donald Broadbent and others in what would eventually become cognitive psychology. Their work, and the work of their several peers in other human sciences, broke with a decades-long tradition in which all the most interesting questions about psychology were left to practitioners of disciplines that were in sympathy with the literary arts.

This tradition had established itself in the English-speaking world around the beginning of the twentieth century when – for reasons that were partly to do with logical positivism, but that also had to do with psychology's desire to establish its credentials as an empirical science – all the most interesting mental phenomena were dropped from the experimental psychologist's research agenda. Questions about the constitution of the conscious self were either referred out to the more speculation-tolerant discipline of anthropology, or else they were deliberately ignored by the 'objective psychology' that studied only outwardly manifest behaviour. If, in the first half of the twentieth century, one wanted to know about the mental phenomena that feature in our experience of ourselves as the agents of actions and decisions, one turned not to the empirical sciences of the mind but to those disciplines such as Freudian psychoanalysis, that employed more hermeneutic methods than experimental psychology would allow itself.

By 1958 the case for this division of labour had collapsed. Broadbent's 1958 book *Perception and Communication* made the first sustained and authoritative attack on the positivists' idea that the scientific method required one to remain silent about the inner occurrences of psychology. It did so by showing how the mathematical theory of communication and information could be used to systematise one's thinking about those inner occurrences. It was these same theoretical resources (although with a greater emphasis on computation) that were at work in Chomsky's 1957 treatment of the psychological basis of language, and again in his 1959 attack on Skinner's behaviourism.

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[4] Elizabeth Anscombe, 'Modern Moral Philosophy', *Philosophy*, 33/1 (1958) p. 1.

Both Chomsky and Broadbent treated these new theoretical resources cautiously. The role played by communication theory in Chomsky's *Syntactic Structures* was not, in the first place, that of providing the vocabulary for a positive claim about human language, but only of enabling a negative claim, concerning the inadequacy of behaviourism's 'conception of language as a Markov Process',[5] to be formulated precisely. The same wariness about the overselling of communication theory can be seen in Broadbent's work. In his opening chapter, Broadbent characterises the 'current popularity of language derived from communication theory for the statement of psychological problems' as 'a purely linguistic device, which by itself will not provide the answer to the problems of psychology'. In making this assessment Broadbent was explicitly echoing Richard Gregory, in whose work information theory was being used to model the limits of visual perception (whereas Broadbent himself focused more or less exclusively on audition). He was also echoing a sentiment that had been expressed by Claude Shannon, whose seminal paper 'A Mathematical Theory of Communication' had single-handedly established the field of information theory a decade earlier.[6] In a short 1956 note, published under the title 'The Bandwagon', Shannon cautioned those who hoped to apply information theory more broadly that:

> Seldom do more than a few of nature's secrets give way at one time. It will be all too easy for our somewhat artificial prosperity to collapse overnight when it is realized that the use of a few exciting words like *information, entropy, redundancy,* do not solve all our problems . . . workers in other fields should realize that the basic results of the subject are aimed in a very specific direction, a direction that is not necessarily relevant to such fields as psychology, economics and other social sciences.[7]

Shannon nonetheless went on to admit that he was himself optimistic about the deployment of information theory in psychology, economics, and the other social sciences − 'I personally believe that many of the concepts of information theory will prove useful in these other fields' − and, as Broadbent notes, even if the contribution of information theory to psychology consisted only of 'a few exciting words', then, nonetheless,

[5] Noam Chomsky, *Syntactic Structures* (The Hague 1957) p. 34.
[6] Claude Shannon, 'A Mathematical Theory of Communication', *Bell Systems Technical Journal*, 27/379−423 (1948).
[7] Claude Shannon, 'The Bandwagon', *IRE Transactions on Information Theory*, 3 (1956) p. 3.

these 'new vocabularies do involve some shift in basic assumptions': the vocabulary of information theory – just by virtue of its being a purely formal theory, in which argument proceeds by mathematical deduction – involved a shift in basic assumptions about the way in which psychological explanation is to be achieved.

The earlier tradition of psychological thinking aspired to explanations with a form that poetry could use and that literary criticism could engage with. It aspired to make mental and social phenomena intelligible by giving an account of them with virtues that were at least analogous to the virtues of narrative coherence and cogency. The effect of Broadbent's and Chomsky's importation of communication theory into psychology was to enable experimental psychology to return to aspects of the mind that run deeper than mere behaviour, but to do so with new standards of explanatory adequacy, having none of the hermeneutic fecundity of their predecessors.

The explanations of the new psychology were not the reductive explanations that were thought to be distinctive of the natural sciences (at least according to the then dominant view articulated by Ernest Nagel[8]). If they had been simply that then – 'reductionism' having been established as a term of intellectual abuse some years previously – the opponents of the cognitivist turn that Chomsky and Broadbent were taking would have been ready with a still familiar rhetoric of dismissiveness. But the new psychology was not reductive. It was not seeking to ground psychology in biology, chemistry, or physics. Instead it proceeded with the formal explanatory resources that put psychology on an abstract grounding drawn, not from the lower-level sciences, but from mathematics.

Just as this cognitivist approach was displacing hermeneutics from its place in the production of psychological explanations, so the tradition of poetry that had emerged from a more or less Freudian concern with the handling of symbols was beginning to seem a spent to be.

This is explicitly noted in Donald Davie's 1956 critique of T. S. Eliot's *Four Quartets*, and it is noted with a conspicuous display of ambivalence: Davie concludes his treatment of Eliot's *Quartets* by expressing the hope that the era of 'post-symbolist poetry' was over, but, as in Conquest's anthology from that same year, Davie makes no attempt to find terms with which to articulate the principles by which a new era of poetry might be guided. In the absence of such terms, his optimism more or less declares itself to be groundless:

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[8] Ernest Nagel, 'The Meaning of Reduction in the Natural Sciences', in *Science and Civilization* (Madison, Wis. 1949) pp. 99–138.

If I hope for a different sort of poetry, that hope is reasonably confident – not because I give much weight to the younger poets of today who, when they think in these terms at all (they seldom do), declare the post-symbolist tradition is 'worked out'; nor even because the respectable poetry written in England and America by poets younger than Eliot is plainly not written according to his prescription; but simply because the *Four Quartets* represent a stage of such subtlety and intricacy in the post-symbolist tradition that it is impossible to think of its ever being taken a stage further . . . It is, at any rate, in this hope and this confidence of something quite different in the offing, that I have written the second half of my title: 'T. S. Eliot: *The End of an Era*'.[9]

It is telling that the *Four Quartets* remained, in 1956, the last landmark relative to which Davie thought the poets of his generation could orient themselves. Much had happened in the years since the publication of the quartets (in 1936, 1940, 1941, and, as a single volume, in 1942). It was not only that the war had ended, nor only that America, as we have seen, had gained but was no longer gaining a cultural status that it had not previously enjoyed. There had also been a very great deal of more mundane social innovation, affecting the quotidian interactions between the individual and the apparatus of culture, especially in England: television had become established as a popular medium, the BBC's monopoly on broadcasting had been broken, and a new wave of red brick universities had been founded. Received wisdom about the composition of the English cultural establishment had thereby been undermined. New terms needed to be found with which to debate the basis on which one could claim the authority to make pronouncements, whether in verse or prose, about the significance of literature to the still emerging postwar society. Eliot, as Davie indicates, had previously been endowed with such authority. But in 1958 his claim on it was sufficiently unclear that Robert Graves could be sniffy about its basis:

the Cultural Establishments both of the United States and the United Kingdom, feel ashamed that the present era of rapid material and scientific progress has been glorified by no bearded bard of Whitman's stature, or Tennyson's. They cast around for a name to fill the gap, preferably one approved by the younger intellectuals. Pound is not politically respectable, but what about T. S. Eliot? *The Wasteland* has been their beacon for the last thirty years, and Eliot's record is academically

[9] Donald Davie, 'T. S. Eliot: The End of an Era', 1956 p. 24, reprinted in his *Modernist Essays: Yeats Pound, Eliot* (Manchester 2004).

clean: he unsaid his harsh judgment of Milton, and cannot be accused of writing any love poems since his school days. True, *The Wasteland* is not really a long poem, or even a long short poem, but a collage of lyrical and dramatic pieces . . . However, Eliot's *Four Quartets*, taken in a lump, are lengthy enough and adult enough and religious enough and philosophical enough to pass as a masterpiece. So the *Four Quartets* ('with *The Wasteland* taken into consideration,' as the courtroom reporters put it) have elevated Eliot into a major poet.[10]

Graves was no doubt indulging his taste for controversy when he said this, and it is perhaps significant that when he published it (in a collection of his various writings timed for the 1958 Christmas market) he positioned this talk so that it appears immediately after one in which Eliot is treated rather more admiringly, thereby breaking what would otherwise have been a chronological ordering. Whether or not Graves intended that juxtaposition to be mitigating, the fact that he said these things at all, and the fact that he printed them in a popular and well-received book, is all the more telling because their inaccuracy would have been obvious. By 1958 Eliot himself had long since ceased to make any claims to precedence as a cultural critic of the sort that Graves was envisioning.

Nowhere in Eliot's later prose does he cast himself in the role that Graves was then suggesting the 'Cultural Establishments of the United States and United Kingdom' had assigned to him: the 'glorifying' of the 'present era of rapid material and scientific progress'. Of course Eliot was aware of such progress as relevant to the poet's business. But it is hard to believe that Graves seriously thought that anyone in the cultural establishment regarded the writing of 'The Waste Land' as a qualification for the role of society's glorifier. Eliot was never much inclined to glorify any social phenomena as profane as the 'material and scientific progress' that Graves mentions, and by 1958 he was not much concerned with attempting to address anything as inchoate (or as profane) as what Graves calls 'the present era'. It is true that Eliot's 1956 volume *On Poetry and Poets* reprints his 1945 attempts to gauge 'the social function of poetry in its largest sense' in which Eliot tells us that poetry may make a difference 'to the speech, to the sensibility, to the lives of all the members of the community, to the whole people, whether they read or enjoy poetry or not: even, in fact, whether they know the names of their greatest poets or not'.[11]

[10] Robert Graves, *Steps* (London 1958) p. 115.
[11] T. S. Eliot, *On Poetry and Poets* (London 1956) p. 22.

But *On Poetry and Poets* also reprints Eliot's 1936 'harsh judgment' of Milton, together with the sequel which Graves satirically characterised as Eliot's attempt to unsay that judgement. It is therefore clear that Eliot's intention in publishing *On Poetry and Poets* was to archive, rather than to reassert, the claims of the essays that he collected there. None of the essays in *On Poetry and Poets* that date from after the war make any claims about broader social functions for poetry. They are much concerned with literary contexts, but not with any social contexts broader than that of the university.

This shift away from the war work of presenting and solemnising cultural identities was (like the shift in his attitude to Milton) presented by Eliot himself as a consequence of changing circumstances, not as a change of mind. In the brief preface added to the 1962 edition of his 1948 *Notes Towards the Definition of Culture*, when Eliot tells us that he finds the persistence of his stance regarding that book's themes to be remarkable, his point is not to suggest that culture had held fast, so that what had been true of it in 1948 remained true in 1962. His point is quite the opposite. The most confidently struck note, among the caveats and cautions that introduce the volume, is the claim that culture, as Eliot had understood it, is no longer a guiding principle for the society in which he was writing: 'We can assert with some confidence that our own period is one of decline; that the standards of culture are lower than they were fifty years ago; and that the evidences of this decline are visible in every department of human activity'. Eliot's 1962 preface was suggesting, not that culture in the interim had held its ground, but that this decline had continued. Nothing is added to modify the pessimism, or the resilience, in Eliot's 1948 judgement: 'I see no reason why . . . we may not even anticipate a period, of some duration, of which it is possible to say that it will have no culture. Then culture will have to grow again from the soil.[12]

When the essays republished in *Notes Towards the Definition of Culture* and *On Poetry and Poets* do show Eliot speaking as if with an authoritative understanding of the culture in which he was writing, and of the place of literature within it, we read them as a protest against the fact that only remnants of that culture looked likely to have survived the war. He never returned to the religious perspective on time and timeliness that, in the paced repetitions of 'a time for living and for generation', 'The time of the seasons and the constellations', 'A time for the evening under lamplight', had been evoked throughout 'East Coker', as a response to the sense that 'As we grow older | The world becomes stranger'.

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[12] T. S. Eliot, *Notes Towards the Definition of Culture* (1948; London 1962) pp. 19, 17.

We have seen that Graves's disparaging remarks about Eliot's standing did not earn their place in his 1958 book on account of their accuracy as reflections on Eliot's status or authority. Their assertability was owing, not to their truth, but to their success in articulating an established anxiety – one that Eliot himself was alive to – concerning the fact that the role of 'presiding bard' was an unfilled one at a moment when it was especially desirable that the role be filled.

There were, of course, established theorists, some of whom, like Lionel Trilling, were willing to pass judgement on 'the crisis of our culture'. Northrop Frye, in Toronto, and G. Wilson Knight (in Leeds but also with a Toronto connection, having spent the decade leading up to the war there), were keen to elucidate the relation of local literature to its global and historical contexts. But works such as Frye's 1957 *Anatomy of Criticism* sought to situate works of literature relative to timeless mythic schemes of plots and archetypes. They were not concerned with poetry's place in the particular social context of the late 1950s. Nor did the emerging cultural semiotics of continental Europe attempt to give an account of the contemporary cultural role of poetry. Roland Barthes's 1957 *Mythologies* was concerned with current social significance, but primarily with the significance of such phenomena as all-in wrestling, fashion, and the health effects of wine.

The influence of these various works was such that their combined effect was to make it seem either quaintly parochial, or else staid and snobbish, to concern oneself with anxieties about the present role of poetry in culture, and in our understanding of the modern mind. And yet such anxieties were pressing. They were pressing on Graves, in his unfair remarks on Eliot. They were pressing on Eliot, in his preface reasserting his remarks on cultural decline, and on Davie, in the ambivalent 'hope' with which he declared that poetry had reached 'the end of an era'.

They were all the more pressing because it was not only from the understanding of psychology that the literary critic of 1958 seemed suddenly to have been alienated, but also from the project of understanding society more generally. Sociology, especially in its more anthropological moments, had long taken the study of language as a paradigm. It is therefore no surprise that a diluted version of the technical apparatus that Chomsky had introduced to the study of language immediately established itself as a paradigm for the explanation of cultural phenomena more generally.

In the structural anthropology of Claude Lévi-Strauss – as presented in his 1958 book *Anthropologie structurale* – the anthropologist's job is understood to be a variety of syntactic analysis which, exactly as with Chomsky's treatment of generative grammar, is primarily a formal matter, to be achieved by an abstract description of the information-handling mechanisms from which social structures emerge. This point is one that

Lévi-Strauss was later to be quite explicit about. Without mentioning Chomsky by name, he adopts a recognisably Chomskian stance when, in the 'overture' to *The Raw and the Cooked*, he sets out the explanatory aims that characterise his approach by telling us that 'Syntax does not wait until it has been possible to enumerate a theoretically unlimited series of events before becoming manifest, because syntax consists in the body of rules which presides over the generation of those events. And it is precisely a syntax of South American mythology that I wanted to outline.'[13]

Here, as before, the formal vocabulary of syntactic rules and generative grammars introduces formal explanatory standards to the human sciences, and thereby eschews the hermeneutic standards of narrative coherence, sympathy, and cogency. Just as Anscombe's 1958 article protested that the resulting philosophy of psychology was inadequate for understanding moral phenomena, so we find the equally Wittgensteinian philosopher Peter Winch mounting a protest against a larger application of these explanatory standards to social phenomena more generally.

The arguments of Winch's 1958 book, *The Idea of Social Science and its Relation to Philosophy*, position him in direct opposition to the structuralist who, like Lévi-Strauss, wants to provide an explanation of social phenomena by using purely formal syntactic tools, analogous to those that Chomsky was deploying in linguistics. The narrative and hermeneutic virtues that such explanatory aspirations abandon were, in Winch's account, essential if our explanations are to provide understanding at all:

> the central concepts which belong to our understanding of social life are incompatible with concepts central to the activity of scientific prediction. When we speak of the possibility of scientific prediction of social developments of this sort, we literally do not understand what we are saying. We cannot understand it, because it has no sense.[14]

Winch was writing at the very same time as Chomsky, Broadbent, and Lévi-Strauss. He was not responding to them but to the general turn of thought that they embodied. It is this same turn of thought – the abandonment of the attempt to explain human phenomena by narrating them, and the establishment of attempts to explain those phenomena with the abstract deductive framework of a purely formal system – that we have discerned as a motivation in the exactly contemporary work of

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[13] Claude Lévi-Strauss, *The Raw and the Cooked*, trans. Johnand Doreen Wightman (New York 1969), p. 16.

[14] Peter Winch, *The Idea of Social Science and its Relation to Philosophy* (Abingdon 1958) p. 88.

Anscombe, Davie, and Graves. It was an idea that made an impact outside academe, more or less immediately.

IV

It was in an article published in *The New Statesman* in 1956, and in a pair of articles published in *The Sunday Times* in 1957, that C. P. Snow first drew the attention of a wider public to the potentially unhappy dissociation between literary culture and the new developments of science. These articles appeared in high-profile venues, and similar ideas were being presented elsewhere by others, but in 1956 and 1957, as Snow would later write, 'none of us got much of a response'. In 1959 Snow gave the definitive treatment of this topic in his Rede lecture on 'The Two Cultures and the Scientific Revolution'. This time, although the public profile of the venue was much lower, the response was a famously noisy one, and seemed disproportionate to the lecture by which it was provoked. Snow himself tells us that 'By the end of the first year I began to feel uncomfortably like the sorcerer's apprentice. Articles, references, letters, blame, praise, were floating in – often from countries where I was otherwise unknown'.[15]

After 1964, when F. R. Leavis entered the debate as spokesman for those who opposed Snow, the suddenly raised profile of Snow's concerns can be partly attributed to the allure of rhetorical savagery. Starting a fight remains a depressingly reliable way to get attention, in the academy as elsewhere. Leavis's February 1964 lecture 'Two Cultures? The Significance of Lord Snow' (later published in *The Spectator*) continues to attract attention, and not only from academics, for its accusations that Snow has 'an utter lack of intellectual distinction, and an embarrassing vulgarity of style', and for its claim that Snow is 'utterly without a glimmer of what creative literature is, or why it matters'.

The level of Leavis's vituperation seemed stagey even to commentators at the time. Writing in 1962, in his 'London Letter' for the *Hudson Review*, John Wain explained the profile of Leavis and Snow's debate as being due, not to the importance of the points that were in contention, but to the value of the argument as a diversion from the 'public and private worries' that characterised the age. In the face of such worries, Wain tells us,

> people welcome diversions, and there have been several on the literary- intellectual scene lately. Much the biggest was a certain judo demonstration given at Cambridge on February 28th, under the title

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[15] C. P. Snow, *The Two Cultures: And a Second Look* (Cambridge 1965) p. 54.

of the Richmond Lecture, when F. R. Leavis, as if to prove that on the eve of retirement he has lost none of his skill, threw Sir Charles Snow over his shoulder several times and then jumped on him. . . .

Such echoes as reached the man in the street appear to have confirmed him in his belief that 'intellectuals' are people who spend all their time indulging in passionate feuds of obscure motivation.[16]

Wain is surely right that Leavis's lecture had some value as a public diversion from the public and private anxieties of the moment, but Wain's characterisation of those anxieties leaves it obscure as to why a debate about literary culture should provide the distraction that those worries call for. The 'public worries', on Wain's account, were '(1) physical survival, (2) economic survival, (3) social welfare and (4) education'. The private ones were 'whether we are getting lung cancer from cigarettes, and in general how to get more love and money'. Snow's own account of the fact that his 1959 lecture 'produced a hubbub', whereas his 1957 articles went unremarked, does not even go as far as Wain in explaining why this should have been: Snow tells us that something culturally important was rather suddenly going on, but for him this shift is merely 'a reminder of the mysterious operation of what, in the nineteenth century, was reverently referred to as the *Zeitgeist*'.[17]

We can make Snow's encounter with this operation of the zeitgeist rather less mysterious, and can even make the extent of Leavis's vituperation seem somewhat less baffling, by seeing both in the light of the explanatory revisions that coincided with them (which I considered above), and by seeing these in the light of the logical discoveries that underpinned them (which I shall consider shortly). But to understand the way in which these logical developments were able to exert their cultural influence so widely and so suddenly, we need first to note the extraordinary context of technological innovation in which they occurred.

V

The most assertively trumpeted technological innovations in 1958 were those of nuclear physics and space exploration. In October 1956 Queen Elizabeth had opened the UK's first nuclear power station – the facility at Calder Hall – serving primarily to produce plutonium for the military (as had previous nuclear facilities) but also serving,

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[16] John Wain, 'London Letter', *Hudson Review*, 15/2 (1962) p. 253.
[17] Snow, *The Two Cultures*, p. 54.

unlike its predecessors, as a source of electricity for civil use. The development of the Calder Hall facility led to the 1957 White Paper *Capital Investment in the Coal, Gas and Electricity Industries.* The political decisions taken on the basis of that paper led to the Nuclear Installations Act (which eventually passed into law in July 1959) and so gave nuclear physics a central place in UK energy policy.

The rapid development of nuclear energy facilities in these years took place conspicuously, and loomed large in the public consciousness. The technological innovations employed by the nuclear facilities were celebrated. In the boy's weekly *Eagle*, for example, sectioned drawings were published explaining the Calder Hall plant's design and operation.[18] The consequences of nuclear developments were also widely feared. Despite government efforts to manage the public image of the nuclear industry, concerns about its safety had their own vivid images to accompany them. The fire at the Windscale nuclear reactor in October 1957 could not be kept from the public's attention, since the resulting fallout required the milk from nearby farms to be seized and, for several weeks, dumped into the Irish Sea. In February 1958, the first public meeting of the Campaign for Nuclear Disarmament took place. In April that year the first of the Aldermaston protest marches took place. These were the 'public fears about survival' that Wain identified as the backdrop for the Leavis–Snow debate.

The same years saw the Soviet Union enjoying its most conspicuous successes with the Sputnik programme. Sputnik I was launched in October 1957 and fell back into the atmosphere in January 1958. As if that weren't enough to catch the public's imagination, Sputnik II – carrying Laika the dog – was launched in November 1957 and re-entered the atmosphere – complete with her remains – in April the following year.

These innovations not only affected the public attitude to science, they also affected the public attitude to the status and authority of the scientist. Again, the response was an ambivalent one. The high-profile developments of nuclear physics and space exploration had established it as common knowledge that the latest technological developments were developments on which the future of society would depend, but also that they were developments that could be properly understood only by those possessed of an expertise the acquisition of which required devotion to topics that lay outside the range of those that are represented and celebrated in the received culture. In the US an article from the October 1958 edition of

[18] See Adrian Ham and Robert Hall, *A Way Forward for Nuclear Power* (UK Department for Business, Innovation and Skills, 2006).

Popular Science excitedly reports on a 'multimillion-dollar crash program . . . to perfect wholly new ways of teaching high school physics'. One of the top five distinctive features listed for the new course is that 'Great pains are taken to "build an image" of the physicist as a hard-working citizen with an interesting and valuable – but not queer – job '.[19]

In the last of these aims this education programme was only just too late. The *OED* lists a 1957 letter by Jack Kerouac as the first instance for sense 2 of 'geek', as meaning: 'An overly diligent, unsociable student; any unsociable person obsessively devoted to a particular pursuit'.

It was these suspiciously regarded practitioners of esoteric sciences (or, more accurately, of the newly esoteric engineering) that Snow had in mind when he wrote 'If I were to risk a piece of shorthand I should say that naturally they had the future in their bones.' Leavis, of course, was having none of that:

> he says 'they have the future in their bones'. He clearly feels that it has an idiosyncratic speech-raciness that gives his wisdom a genial authority. But it is a basic cliché . . . Such a phrase as 'they have the future in their bones' (and Snow repeats it) cannot be explained as a meaningful proposition, and in that sense has no meaning.[20]

Leavis moves rapidly here from the accusation that Snow's language cannot be 'explained as expressing a meaningful proposition', and so is literally meaningless, to the charge that Snow cannot even be credited with the having of a thought: 'though Snow clearly feels that he is expressing thought, the thought, considered even for a moment, is seen to be a mere phantom'. The criteria for having thought that such an argument requires are absurdly stringent. It cannot really have been Snow's failure to express a proposition that Leavis was so upset about. Nor can it simply have been Snow's verdict that the future state of society depended on work by the practitioners of the rapidly developing and increasingly esoteric sciences. That much was obvious. We have seen that even Robert Graves agreed with it, and Leavis himself acknowledges as much:

> the advance of science and technology means a human future of change so rapid and of such kinds, of tests and challenges so unprece-dented, of decisions and possible non-decisions so momentous and

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[19] *Popular Science* (Oct. 1958) p. 143.
[20] F. R. Leavis, *Nor Shall My Sword* (London 1972) p. 51.

insidious in their consequences, that mankind – this is surely clear – will need to be in full intelligent possession of its full humanity.[21]

Nineteen fifty-eight's militarily important developments of nuclear power and of space exploration gave undeniable currency to the idea that the advance of the esoteric sciences would be of the first importance. But it was not these alone that raised a challenge for our conception of what it is to be in 'full intelligent possession of our full humanity'. The most consequential innovations, from that perspective, were those that led Jack Kilby, working in September 1958 in the labs of Texas Instruments, to the development of the first integrated circuit.

Like much of the research conducted by Texas Instruments, the development of the integrated circuit was naturally understood as being a contribution to the arms race on which military survival might have come to depend, but it was also immediately recognised as leading to a rapid acceleration of progress in the project of automatising computations, and so as adding new urgency to the need to find a cultural understanding of our relationship with computers.

That need was already well established in 1950 (even before Alan Turing's seminal article on 'Computing Machinery and Intelligence', published in *Mind* in October of that year). An article from *Time* magazine in January 1950 had reported on the prospects for developments in computing to create a '"second industrial revolution", which will devalue the human brain as the first industrial revolution devalued the human arm'. The article maintains a more or less neutral stance on the question of whether such a revolution is likely to be imminent, but it does warn that 'Nearly all the computermen are worried about the effect the machines will have on society.' By December 1958 the introduction of subscriber dialling to UK telephone exchanges had made it common knowledge that the implementation of communication theory allowed at least some humans – the telephone operators to whom one had previously spoken when placing a long-distance call – to be replaced by machines. In that same year the prospect of humans being replaced by machines more widely was elevated from journalistic conjecture to practical possibility by the development of the integrated circuit. And it is in that year too that we find the first appearance of the idea that such developments in computing power might accelerate to a cataclysmic 'technological singularity'. This idea seems first to have appeared in a conversation between John von Neumann and the Manhattan Project physicist Stanislaw Ulam,

[21] Ibid., p. 60.

recounted by Ulam in his memorial notice for von Neumann, published that May:

> One conversation centered on the ever accelerating progress of technology and changes in the mode of human life, which gives the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, could not continue.[22]

Von Neumann knew well that there were logical limits to the intelligent capacities that any information technology could achieve, but the nature and source of these limits was such as to compound the anxiety resulting from the establishment of formal methods in the human sciences. The limits in question follow from Gödel's 1931 proof of the incompleteness of arithmetic.

VI

The significance of Gödel's work in the present context depends on the consequences of Gödel's second incompleteness theorem for 'Hilbert's Programme' in the foundations of mathematics. Hilbert had aspired to solve the so-called *Entscheidungsproblem*, by showing that every truth about real numbers could be derived by applying precisely formulated inference rules to a finite set of axioms. For Hilbert, working at the end of the nineteenth century, the success of this programme would have been epistemically reassuring. By 1958 it would also have been somewhat unsettling for the professional mathematician, since the application of precisely formulated inference rules to finite sets to axioms was by then the sort of thing that computers were very good at. In 1957 Alan Newell, J. C. Shaw, and Herbert Simon had published the results of their attempts to build a 'Logic Theory Machine'.[23] They had thereby demonstrated that some bits of formal reasoning could indeed by implemented mechanically. In the summer of 1958 Martin Davis and Hilary Putnam developed the computational methods that would enable automated deduction to be usefully applied to a broad range of logical and mathematical problems.[24] The

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[22] Stanislaw Ulam, 'John vonBeumann: 1903–1957', *Bulletin of the American Mathematical Society*, 64/3 part2 (1958) p. 5.

[23] A. Newell, J. C. Shaw, and H. A. Simon, 'Empirical Exploration of the Logic Theory Machine: A Case Study in Heuristics', *Papers Presented at the February 1957 Western Joint Computer Conference: Techniques for Reliability* (1957) p. 218.

[24] Martin Davis and Hilary Putnam, *Computational Methods in the Propositional Calculus* (Rensselaer Polytechnic Institute 1958).

success of Hilbert's programme would therefore have led to an unsettling conclusion: It would have shown that – in so far as it is the job of mathematicians to uncover truths about the real numbers – mathematicians could have been replaced by computers.

Fortunately for the mathematicians, no such threat ever needed to be taken seriously since 1958's innovations made the mechanical implementation of formal computations into a practical possibility only after it had been established, as an immediate consequence of Gödel's Second Incompleteness Theorem, that Hilbert's programme could not be successfully carried through.

This, as Gödel himself had realised, did not entail that mathematical proof was entirely beyond the scope of computation. In his now celebrated 1956 letter to the dying von Neumann, Gödel notes that, if the function specifying the maximum number of steps required by a machine to determine whether there is a proof of length n for any formula of the predicate calculus were a function that grew no faster than n or n^2, then 'it would have very important consequences. It would apparently mean that in spite of the unsolvability of the *Entscheidengsproblem*, the reasoning of mathematicians about yes-or-no questions can be completely replaced by machines . . . It seems quite possible to me that [this function] grows slowly.'

The question of whether this function does indeed grow slowly is the P *vs* NP question, and it is this unanswered puzzle that lies at the heart of current computational complexity theory. For as long as this question remains unanswered it will continue to be plausible that a lot of the thinking that mathematicians do is thinking of a sort that no computer could implement, or even check. And even if it turned out that the function Gödel mentions *does* grow slowly – and that would be a very surprising result indeed – the incompleteness theorems would still guarantee that some mathematical facts lie beyond the scope of what any machine could discover. The mathematicians of 1958 therefore enjoyed a logical guarantee that their domain was one that computers could not master.

Scientists were in a similar position, although they were somewhat less comfortable to be there. Throughout the 1940s, Rudolph Carnap, Carl Hempel, and others had been attempting to do for scientific reasoning what Hilbert had wanted to do for mathematics, and what Frege had done successfully for deductive logic, namely, to assuage worries emerging from the unprecedentedly revisionary innovations of preceding decades by giving a systematic account of the sort of reasoning involved in the making of such innovations, and by giving that account in such a way as to allow the validity of the reasoning in question to be demonstrated with purely formal methods. With the publication in 1954 of Nelson

Goodman's *Fact, Fiction and Forecast*, it had become clear that there were difficulties of principle, not merely technical obstacles, that had thwarted these efforts.

What Goodman's work made clear was that any formal account of the confirmation relation between data and hypothesis was bound to fail. His 'New Riddle of Induction' showed that a set of data that confirms one hypothesis could *fail* to confirm an alternative hypothesis, despite the fact that that alternative has exactly the same logical form as its rival, and stands in exactly the same *formal* relation to those data. From this it follows that whatever confirmatory work might be accomplished by the inductive reasoning with which a scientist moves from knowledge of some data to a belief in the truth, or in the probability, of his theory, it is not work that this reasoning is able to accomplish by virtue of its form. Attempts to use a formal account of induction to assuage any doubts about the rational status of scientific reasoning were therefore bound to fail.

This result was not unanticipated. As early as 1929 Jan Łukasiewicz had suggested that research on inductive reasoning was unlikely to result in a formalised logic of induction. Łukasiewicz took this to be a good thing for the scientist's self-conception. A Hempel-style attempt to give a formal account of scientific reasoning, in his view, 'undermines the free intuition of a scientist'.

By the end of the 1950s these ideas had a new significance (although Łukasiewicz's contribution to them went unacknowledged, largely because the 1958 second edition of his logic textbook omitted the appendix in which these ideas were developed). Again, the significance was owing to the fact that by 1958 it was true for the first time that syntactic algorithms for conducting formal reasoning could feasibly be implemented by mechanical computers, using only the technological resources that were then available. Łukasiewicz and Hempel's question of whether scientific reasoning was formalisable, or whether it involved a free play of (epistemically questionable) 'intuition', had therefore become a way to ask whether such reasoning could be implemented in a computer or whether, in the course of scientific reasoning, scientists exercise aspects of their humanity that distinguish them from such a machine. The effect of Goodman's work on the impossibility of giving a syntactic account of induction was therefore to suggest that scientific reasoning is provably different in kind from anything a computer could accomplish. The epistemic credentials of scientific reasoning were thereby left without a formal corroboration, but the essential humanity of the scientists' practice was, by that same token, confirmed.

VII

These epistemological and logical points provide the foundations for the account of science that Michael Polanyi elaborated in his 1958 book, *Personal Knowledge.* Polanyi understood science to be an authoritative source of knowledge, but only after proposing some radical revisions to our philosophical conception of what knowledge consists in and requires. With their emphasis on the scientist as 'skillful' (chapter 4), 'passionate' (chapter 6), 'convivial' (chapter 7), and 'committed' (chapter 10), these revisions break with the austere Hempelian ideal of formalisability in ways that were by no means unattractive.

Polanyi probes a number of ideas that have recently been enjoying popularity in feminist epistemology, and in some strands of the philosophy of mind, where they are characterised as 'embodied', 'enactive', or 'performative'. His view was that we should

> regard knowing as an active comprehension of the things known, an action that requires skill. Skillful knowing and doing is performed by subordinating a set of particulars, as clues or tools, to the shaping of a skillful achievement, whether practical or theoretical . . . Clues and tools are things used as such and not observed in themselves. They are made to function as extensions of our bodily equipment and this involves a certain change of our own being.[25]

It is crucial for Polanyi, as for the more recent theorists whose work he anticipates, that the knowledge that figures in this 'skillful knowing and doing' is independent of the knowledge that is explicitly stated in the scientist's textbooks or lectures. Polanyi's handling of this point has been somewhat overshadowed by the treatment that it later received from Thomas Kuhn.[26] For Kuhn, the lack of an explicit formulation of the information that skilled mastery encodes is taken to be essential for its playing of an epistemically foundational role. In this connection Kuhn cites Polanyi, but his reasons seem rather to have been Wittgensteinian. (The influence of Wittgenstein was high at the time, thanks in part to the interest generated by the publication, in 1958, of his *Blue and Brown Books*.) Polanyi's own presentation of this point is without Kuhn's Wittgensteinian sympathies. For him the importance of the inexplicitness of the knowledge that our skills embody is not that it makes this knowledge epistemically

[25] Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (London 1959) p. vii.
[26] Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago 1962).

foundational, but that it makes the transmission of such knowledge essentially cultural, in ways that depend on authority and tradition:

> An art which cannot be specified in detail cannot be transmitted by prescription, since no prescription for it exists. It can be passed on only from master to apprentice . . . To learn by example is to submit to authority . . . A society which wants to preserve a fund of personal knowledge must submit to tradition.[27]

Polanyi thereby gives us a conception of scientific knowledge as being achieved through practices which are heroic, convivial, epistemically reputable, and essentially cultural. This conception, as I have emphasised, was founded on logical theorems pertaining to the limits of computation and the formalisability of induction. The literary establishment of 1958 was lacking the resources to frame such a self-conception, but it was very much concerned with examining the relations of authority and tradition that bring Polanyi's knowledge-transmitting cultures into existence.

VIII

Alan Sillitoe's 1958 novel *Saturday Night and Sunday Morning* is representative of the way in which these concerns were treated in literary contexts. The most nuanced of the relationships in 'Saturday Night' (the first, and much the longest, of the novel's two sections) is the relationship between Arthur, the young protagonist, and Jack, the sympathetic older colleague at the bicycle factory where he works. Arthur is not without respect for Jack. It is his opinion that 'Jack is a good bloke. One of the best.'[28] But theirs is very far from being an apprentice–craftsman relationship of the sort that Polanyi tells us is essentially tradition-creating, and essential for the transmission of tacit knowledge: for the greater part of the novel Arthur is sleeping with Jack's wife, with the full knowledge of Jack's children, and perhaps with less than total ignorance on the part of Jack himself. For much of the novel he is sleeping with her sister too.

Sexual mores also serve as a microcosm in which to gauge the gains and losses of the new liberation of individuals from the strictures of tradition and authority in Iris Murdoch's 1958 novel, *The Bell*. (Nor was this a theme confined to fiction – 1958 also being the year in which Paul Raymond opened Raymond's Revuebar, and the year in which the Obscene Publications Bill was first debated.) Imber Court, the fledgling Christian lay

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[27] Polanyi, *Personal Knowledge*, p. 53.
[28] Alan Sillitoe, *Saturday Night and Sunday Morning* (London 1958) p. 36.

community on whose fate Murdoch's novel centres, is animated by the diffi-culties of negotiating the individual's relation to tradition *ab initio*. It is in part because there is no shared knowledge transmitted through the make-shift cultural rituals of the Imber Court community that the development of that community's life is stunted at a stage that falls short of the self-sufficiency to which its members aspire. And it is this lack of any implicit knowledge embodied in the life of the community's cultural norms that leaves the community without the sort of self-sustaining life that might have reinforced it against those shifts in the balance of its members' various mutual affections that force its eventual collapse.

Similar themes were presented on the stage. The vulnerability and social displacement that put Alison at the centre of the drama in John Osborne's *Look Back in Anger* (first staged at the Royal Court in 1956, first filmed in 1958) are presented partly as resulting from the impossibility of participating in the existing tradition without being stifled by its anachronism. This is especially clear in Alison's relation to her father – 'the Colonel' – who implicitly understands himself and his motives, even in so far as these pertain to his family, against the background of a received social role.

All three of these works had a high-profile reception, but it was *Look Back in Anger* that was most immediately recognised as being part of larger trend. In the theatre that trend was centred on George Devine's English Stage Company, founded at the Royal Court in 1956. It was a trend that moved away from the version of theatre that had depended on the big heroic performances to which Lawrence Olivier, John Gielgud, and Ralph Richardson had owed their fame in the preceding decades. Instead, the protagonists of plays that were emerging from the Royal Court achieved their identity through a struggle against the prevailing social norms. Olivier, with his performance as Archie Rice in Osborne's *The Entertainer* (on stage in 1957 and on film in 1960), proved himself capable of taking on these roles. But his ability to do so seems now to be a testament to his versatility. The characters that were being depicted in English theatres in the final years of the 1950s were, for British audiences, of a quite different type from what had gone before.

The shift was not only a shift towards 'kitchen sink' drama. The plight of the tramps in *Waiting for Godot* (first staged in 1952, and in English in 1955) lends itself – especially in their encounter with the class-stereotype figures of Pozzo and Lucky – to interpretation as an allegory for the state of postwar culture more generally. But by the time we get to *Krapp's Last Tape* (first staged in 1958), any attempt to read Beckett's work as a cultural alle-gory seems to be seeking an excuse to look past the bleakness of its depic-tion of a very definitely individual self. Osborne's and Sillitoe's domestic dramas are only one part of a literary movement concerned with shifts in

the social foundations required for the convivial, committed heroism that Polanyi takes to be essential for the cultural business of transmitting and creating tacit knowledge, and which Beckett's Krapp, Osborne's Jimmy Porter, and Murdoch's Nick Fawley are so devastatingly without.

IX

By 1958, then, scientists could point to the work of Hempel, of Goodman, and of Polanyi to show that their activities were uncomputable, but were instead essentially convivial and cultural. Mathematicians could point to Gödel's Incompleteness Theorem, and to Turing's work on the *Entscheidengsproblem*, to show that what they did in making mathematical discoveries was something that no computer could do. Poets – as we have seen Donald Davie intimate – had nothing compelling to say.

Chomsky's new approach in linguistics was reviving the idea that in understanding the basis of language we are understanding intellectual capacities that are distinctively human. But the way in which Chomsky approached the task of understanding the human capacity for language, in the first chapters of *Syntactic Structures*, was by using the purely formal resources of information theory to prove results about the sorts of computational system that could and that could not be capable of producing well-formed English sentences.

In Leavis's first response to Snow's 1959 lecture, the idea that human language might be computationally implemented is explicit only in one of Leavis's cheaper shots against Snow's status as a novelist (a shot so cheap that Leavis actually distances himself from it):

> as a novelist he doesn't exist; he doesn't begin to exist . . . The nonentity is apparent on every page of his fictions . . . I am trying to remember where I heard (can I have dreamed it?) that they are composed for him by an electronic brain called Charlie, into which the instructions are fed in the form of the chapter-headings.[29]

In the 1972 volume in which Leavis collected his various complaints against Snow, the idea of computationally implementing the human capacity for linguistic creativity returns, again and again, as a symptom either of personal stupidity or of some deep cultural flaw:

> I was, I confess, a little amused when, sitting at a formal lunch next to the director of City Art Gallery, I was told by him, in the tone of

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[29] Leavis, *Nor Shall My Sword*, p. 45.

one saying something very impressive: 'A computer can write a poem' – I replied, very naturally, that I couldn't accept that, adding that it was one of the things that I knew to be impossible. When he responded by being angry, fierce and authoritative, I reflected that he was German, if an émigré, and that in any case his business was *Kunst* and he hadn't said that a computer could paint a work of art.[30]

Leavis found there to be something obviously deplorable in 'the cultural climate that makes it possible for educated persons to assure one that a computer can write a poem'.[31] In this essay we have seen that the conditions that made such a climate possible emerged quite suddenly in 1958. What is remarkable here is not just that Leavis had no way to respond to such assurances other than by getting chauvinistic and angry about them, but that it should be the poet, and not the mathematician or scientist, to whom the acceleration of computational power poses an unanswerable challenge. Such a predicament would have been unimaginable only a few years previously. It was the information theoretic innovations of structuralist linguistics that made it a pressing cultural concern.

[30] Ibid., p. 142.
[31] Ibid., p. 34.