

The Ontology of Innovation: Human Agency in the Pursuit of Novelty

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Abstract: This paper develops an analysis of innovation based on Allen Oakley's (2002) primary themes of ontological priority, agency-structure and critical realism. I develop a history of thought and contemporaneous endogenous view of innovation in an environment of uncertainty, potential novelty and policy priority. Drawing on the literature of Austrian, institutional, Schumpeterian, Penrosean and other schools, I explore a continuum of agency-structure relationships that enhance innovation. These relationships cover environments that are based on agency and contingency, through to those that balance contingency with containment (structure), and situations that are heavily contained. The literature on innovation is investigated vis-à-vis the degree to which different environments encourage creative, original marketable opportunities for the common good. Innovation policy-making is then investigated through the traverse process of irreversibility, and within a retrodutionist planning process. Overall, I seek to advance the cause of realism through innovations generated in different environments.

1 The Research Problem

Ontology is often overlooked in the study and explication of innovation. Does this matter? It matters because 'innovation' has become an important word in the twenty-first century, reflecting all that is modern, progressive and exciting in a complex world. This is reflected in every phase of daily existence in modern capitalist economies. Firms are urged to be innovative to gain or sustain a 'competitive edge'; consultants advertise their strategic advice as the essence of innovation; the survival of local schools depends on the capacity-building that comes from innovation; schools are exalted to have innovation in their curriculum; and universities promote themselves as leaders in innovation. Politicians respond to the need to support all of the above through policies to enhance national innovation.

Ontology is '... the study (or a theory) of being or existence, a concern with the nature and structure of the "stuff" of reality' (Lawson 2003, p. 12). Any study or research has a metaphysical precondition to modelling and empirical validation, whether implicitly or explicitly stated, and this is its ontology. Thus ontology is the foundation of all inquiry. Ontology illuminates the range of empirical phenomena that potentially can be investigated. When it comes to innovation, ontology is poorly conceived or implicitly assumed in an extremely simplistic approach. The reason is that the human actions underlying innovation have rarely been explicated in any clear, consistent manner.

Innovation as a process is complex and poorly understood because it is deeply rooted in the uncertainty of the future world, from which emerge new products, processes, movements, organisations and sources of raw material.¹ All that is known is that innovation brings change and something 'new' emerges, which

cannot be modelled (or only very sketchily modelled). As a result, it is often portrayed as exogenous, and thus anything that cannot be accounted for by quantifiable measures is called 'the residual' and comes about via innovation. Empirical studies from as far back as Edward Denison (1962) clearly show that this 'innovation' residual is very significant, accounting for far more than 50 per cent of economic growth. Economic historians have confirmed the crucial role of innovation in their empirical narratives.²

The research problem that emerges is how to identify and expost a realist and sustainable theory of human action in the innovation process. Orthodox economics conceptualises a general ontology of the economic agent that is based on human action, to which innovation is only one specific application. The results of this approach have been inadequate. The next section identifies these inadequacies within the history of economic thought and argues for an ontology that places innovation and the pursuit of novelty at the centre of human agency. This can form the basis of an endogenous model of innovation and its significant impact on the analysis of economic development. Allen Oakley's extensive work on the problem of human agency is briefly outlined with a view to using his theorising as the basis for a realist ontology of innovation. Then, novelty in human agency is specifically addressed, using heterodox economic thought and contributions from a number of innovation-based studies. A human agency path of innovation is specified and then used in a policy-planning framework applied to the traverse (or structural change path).

2 Inadequate Orthodox Ontology of Innovation

The mainstream economic view of human action is based on the ontological theory of 'rational economic man' (or *homo oeconomicus*). This is the deductivist-logic of an isolated human agent applying optimal economic rational decision-making calculations to all commercial decisions. The representative rational economic agent has the capacity to make all the information processing and computational calculations that are required to optimise any choice alternative faced in terms of accounting and opportunity costs. The aggregation of these representative agents produces optimal equilibrium outcomes. There have been many critiques of this economic agent from two main perspectives. One is that such calculations require superhuman powers in assessing all the costs and benefits involved, and then projecting these into the unknowable future (e.g., Simon 1975). This results in fundamental uncertainty that cannot be reduced to some probabilistic distribution (see Lawson 1988). The other set of critiques focuses on the way this agent is effectively an abstraction, without real-world content, whose behaviour conforms to the idealised world of 'free-to-choose' capitalism (e.g., Lawson 1997; Boland 1997).³

From the innovation management viewpoint, this orthodox view of human agency has produced what John Legge and Kevin Hindle (2004, p. 25) call an 'ignorance' of the 'entrepreneur' who brings forth innovation. Here, the general equilibrium approach 'considers the "state of the world" long after the last innovation has taken place and no further changes can be expected'. In essence, entrepreneurs in a perfectly competitive economy have no economic incentive to innovate when knowledge is instantaneously transmitted. Innovation ends up being exogenous in the orthodox economic model and, thus, resolves two problems. It overcomes the inability of human agents to predict the future and it ensures

consistency of the general equilibrium model. However, this orthodox model sacrifices any claim to analyse innovation within *capitalism*, including the institutions of business management and socioeconomic development.

Legge and Hindle (2004) identify two main attempts to re-introduce innovation into orthodox theory. *Firstly*, at the microeconomic level, principal-agent theory is scrutinised in the economics of management literature (e.g., Brickley *et al.* 1997). Here the principals are shareholders (represented by the company board) who set up an organisational structure to ensure that their wishes are carried out by hired managers. This brings the entrepreneur ‘owner-shareholder’ into direct relation to the original entrepreneur ‘owner-manager’, both acting as the innovative spur for ‘the firm’. Legally, a limited liability company is different from its owners (Kay and Silberston 1995, p. 88); and empirically, corporate firms have been measured in terms of coordinating and combining core competencies as a cooperative process in tune with market reality (Acs and Audretsch 1991). Both aspects undermine the principal-agent theory, as shareholders lack any significant agency role, with corporate managers effectively making the decisions and the board merely rubber-stamping them.

Two other orthodox microeconomic approaches to human agency, including norm-guided behaviour by mental models (e.g., North 1981) and asymmetric market information (e.g., Stiglitz 1987), identify sub-optimal outcomes through methodological individualism. Both advance ‘the claim that structure is entirely the result of individual actions’ (McKenna and Zannoni 2003, p. 2). Fundamental uncertainty, and reduction of institutions to the impact of individual agent behaviour, raises further concerns for the ontology of innovation. Neither approach allows for any endogenous role that innovation can play in the dynamic mutual interdependence of institutions and agents. The innovation research problem is not resolved by these two approaches. Despite their more realist position, as recognised by Geoffrey Hodgson (2004, pp. 395 and 426), it remains the case that institutions are reduced to the autonomous actions of individuals. Such a path ignores the organisational origins of innovation and the role of the ‘social individual’ (Davis 2003), limiting innovation to a peripheral role in market capitalism.

Secondly, at the macroeconomic level, new growth theory relaxes the standard model by focusing on the cost and dissemination of new knowledge or innovation (Romer 1994). Only part of new knowledge is appropriated internally in the firm, while the rest spills over into the community to be appropriated by other entrepreneurs. Legge and Hindle (2004, p. 32) describe the results as ‘unexceptional’ and consistent with the pioneering work of Adam Smith (1776). New growth theory includes no explicit account of how knowledge is attained. Its realist credentials are thus lacking, since it ignores the endogenous generation of knowledge, with fundamental uncertainty and the representative agent problem both remaining.

3 The Problem of Human Agency: The Oakley Contribution

Oakley has devoted much of the latter part of his scholarly career unpacking the problem of human agency within the study of economics; from the classical writers through to the Austrians (old and new) and to the neoclassical mainstream. In Oakley (2002), the project extends to devising a humanist reality of economic agency as a foundation for a reconstructed economic theory. The first principle

Oakley asserts is that empirical research has to be based on some ontology (explicitly or implicitly); otherwise one cannot identify what a researcher focuses on when examining the complex data of human activity. The second principle is that this ontological base needs to be grounded in a realist perspective of human activity in which actions are determined by the structured situations *actually* existing, which also affect this very same structure (Oakley 2002, pp. 18-20). For Oakley the problem of human agency in economics stems from orthodox economics rejecting the second principle by adopting a positivist (or physical scientific methodological) view of autonomous existence and inherent orderliness that denies any role for real-world agents in an open system. This results in orthodoxy constructing complex methods of interpreting data on the implicit acceptance of this very simplistic and normative abstract ontology.

The Oakley contribution is to represent human agents as they have been perceived by philosophers working on the anthropology of social activity, and then to situate such human actions within the economic phenomena of capitalism. This provides the basis for a realist economic ontology and consequently a more appropriate empirical methodology upon which to develop an economic theory. The richness of Oakley's contribution to this enquiry cannot be adequately summarised, and any brief overview will inevitably be a caricature of the thesis he expounds. What follows are merely some crucial elements of Oakley's thesis that form the basis for the ontology of innovation to be constructed in the next few sections.

There needs to be, in Oakley's view, a defensible ontology that can explicate human nature within an economic cosmos. The irreducible aspect of human agency in the economic sphere is centred on choices, decision-making and actions. A satisfactory ontology needs to capture the voluntaristic role of independent human agents in these three aspects of the economic sphere, but also recognise the deterministic social structure that governs all economic phenomena. This is the position developed by the critical realism literature led by Lawson (1997, 2003). Oakley builds on the critical realism account by introducing a rich vein of philosophic writings by major social theorists, including Alfred Schutz, Karl Popper, Herbert Simon and Anthony Giddens. The following extract encompasses the dualistic relation between voluntarism and determinism:

This social and economic cosmos is the unintended collective product of their individual actions immanently and volitionally guided by the situationally imposed rules, facilities and constraints that shape these actions. ... But because of uncertainty and the need to depend upon other people within their social environment, the deliberated actions of individuals will for the most part generate phenomena that include outcomes that were not wholly expected and not wholly desired. (Oakley 2002, p. 192)

The way that this dualistic relation operates within Oakley's thesis is that human agents search for a balance between the contingency of human action and containment that limits this human action. Contingency is a 'free-to-choose' agency concept that is strongly qualified by what agents know (or have learnt) based on their cumulative biography. Individual capacities emerge from this learnt past. In this concept, history matters in a very personal way and can be linked to Michal Kalecki's economic growth dynamics, where the long run is merely the cumulation of a chain of short-period decisions and actions.⁴ Thus, there is no long-run optimality in a realist account of history; instead there is a series of short-period

events that cumulate as a chronicle into an ever-changing long-run dynamic. Choice in such a dynamic is contingent on the past and backtracking is impossible,⁵ which results in irreversible change.

Containment is what Oakley calls the 'situational conditioning of human agency'. Agent's decisions and actions are conditional on the extant information, available facilities and imposed rules (or conventions) that particular societies develop and implement. This is the institutional framework of society that arises out of the situational conditioning. As social beings, human agents learn that it is in their best interests to cooperate by habits and routines with the institutional manifestations of the collective society. This containment of 'the free spirit' has two important implications. One is the recursive (or feedback) effect in which the endogenous cumulative biography of individuals both shape and are shaped by the institutional constraints learnt (or understood). The path of economic development and transformation is 'locked-in' on the basis of this recursive effect. The other implication is that society is prevented from disintegrating into anarchy by institutional containment and reasoned agent behaviour in the face of these containments (e.g., we generally drive on one accepted side of the road). This is the 'complexity' concept of an open system in which '... the collective behaviour of many basic but interacting units' evolves over time, with self-organisation and adaptation (Coveney and Highfield 1995, p. 7).

If society is totally contained by its institutional manifestations, without any room to move outside the given information, facilities and rules, *then* society is in a closed system like a chess game where all the rules are structured and unchangeable. Human action would then be limited to whatever can be created within these highly structured limitations. Anarchy occurs if, on the other hand, there is no containment of rules and structures. A completely open system emerges as with children playing their own developed games where the rules are changed in an *ad hoc* fashion as these games progress in a highly creative way.⁶ Economic phenomena rest on situations that exist between these two extremes.

Oakley argues that it is the relative weighting of the balance between contingency and containment in any specific real-world setting that explicates the sources of human agency and determines its nature. If the weight of containment is greater than contingency, then the system favours generalisability based on strict logical arguments. If the weight of containment is less than contingency, then the system favours less generalisability and leads to more complexity-based arguments that, overall, create and dissolve patterns over time. The crucial issue for Oakley is to capture the right balance between contingency and containment in any particular phenomenon under investigation (Oakley 2002, p. 216). In the discussion below, this question of balance between contingency and containment is referred to as 'C&C'.⁷

From this ontological basis, Oakley identifies three research enquiries in economics. The *first* is to '... seek out any ontologically occurring regularities and universalities that characterize the generation of a particular type of phenomenon' (Oakley 2002, pp. 215-7). For example, this may be undertaken by identifying patterns of behaviour in investment cycles that drive booms and busts (see Courvisanos 1996). The *second* enquiry is '... to supply the regularity and universality that scientific inquiry demands' (Oakley 2002, pp. 215-7) where such characteristics are not found. This requires much deeper research insights which can be ascertained from complexity-type computer modelling (see Courvisanos and Richardson 2006). Finally, in the *third* enquiry the researcher needs '... to design

interventions that maximize the containment and minimize the contingent remainder affecting agents' deliberations and decisions' (Oakley 2002, pp. 215-7). This latter enquiry is referred to as *praxis*, where change comes from understanding how processes work. Policy design strategies should aim to allow agents volitionally to be directed and contained towards desired outcomes; otherwise the policy changes would not be sustainable. Any attempt by agents to maximise contingency leads to anarchy. Oakley therefore argues that the rules need to be set by which agents abide. This is particularly the case for crucial issues like the ecosystem, where contingency must be constrained from the start in framing policy.

By combining this three-pronged research agenda with previous work on Adolph Lowe (Oakley, 1987 and 1994), a traverse (or structural change path) can be devised by working backwards from the desired end to the required means in a search procedure referred to as retroduction. Lowe uses this approach to make 'regressive inferences' and so derive necessary links back to motivational patterns that can be successful in achieving the desired end.⁸ It is through Lowe's traverse that the interaction of volition and constraints can transcend the C&C spectrum, as will be developed later in this discussion.

4 Novelty as the Basis of Innovation

Innovation can be defined as the creative application of knowledge to increase the set of techniques and products commercially available in the economy. The essence of the definition of innovation is novelty, in terms of creative ideas that are commercialised within the economic sphere of human activity.

Faber *et al.* (1996, p. 154) refer to economic genotypes as potentialities that allow for the emergence of novelty. In an economy, this genotype comprises: (a) the preference orderings of agents; (b) a set of known techniques; and (c) institutions (legal, economic and social). Later in this discussion it will be shown how a traverse can be planned to achieve certain outcomes for the common good (e.g., ecologically-based sustainable development that incorporates a drastic reduction of greenhouse gases) by using the above genotype structure. Essentially this needs a process by which containment through the use of the existing institutions can induce particular contingency preference ordering that will result in a specific set of techniques that are consistent with the common good. The economic phenotypes, based around investment and consumption within a market structure, will then be able to realise such potential as ecological sustainability.

The forms innovation can take, in order of their impact on economic development (from low to high), are: (i) continuous (or 'Kaizen'), occurring daily at the workplace; (ii) incremental, based on research and development (R&D); (iii) radical discontinuous, based on entrepreneurship (both corporate and individual/team); (iv) technological systems change, based on a cluster of innovations; and (v) techno-economic paradigm shift due to major structural change (e.g., the steam engine and information technology). Each form of innovation can dovetail into higher order innovation, thus becoming increasingly more important to society.

At the ontological level, why do human agents carry out innovation? Various orthodox exogenous explanations identified in the previous section are essentially '*mana* from heaven' and fail on the realist ontology framework. Non-mainstream (or heterodox) economic paradigms are developing alternative perspectives to rational economic man, but they all '... work with different

strategies for explaining agency' (Davis 1999, p. 464). In his effort to develop a heterodox theory of individual action, John Davis (2003) notes that current diverse and arbitrary heterodox explanations lack coherence. A realist ontological story can emerge from these diverse views that can be the basis for understanding the concept of endogenous innovation.

Outside the economics discipline there are a number of innovation-based sets of literature that provide insights into human agency which specifically contextualise innovation. All the professional literature has useful insights without providing an ontological foundation to innovative behaviour.⁹ There is an implied *homo oeconomicus* assumption in the business professions coming from its roots in orthodox microeconomics, with the uncertainty and representative agent dilemmas remaining intact. Despite this, the strong empirical basis of their research provides a rich source of data that can inform a realist ontology of innovation.

Oakley opened his own investigation of human agency by stating that '... it is this capacity [of agents] for dealing with novelty that is most relevant'. (Oakley 2002, p. 31, fn. 3). This section aims to look directly at novelty as the basis for innovation in theorising a sustainable endogenous ontology of innovation using both heterodox and the professional innovation-based literature. Oakley (2002, p. 31, fn. 4) notes that '... the agents and strategic actions in focus ... are confronted with the problem of adapting habits and routines in order to make decisions in the face of novel situations'.¹⁰ Only the successful adoption of the new routines can lead to the wide diffusion of innovation. Novelty brings into play the balance between C&C.

Using C&C, a spectrum can be identified that encapsulates all forms of innovation. At one end of the spectrum is the entrepreneurship literature that espouses spontaneous responses to economic and social conditions in the way contingency far outweighs containment, resulting in radical innovation (or significantly different incremental innovation). Human actions by agents at this end are strongly influenced by what John Maynard Keynes (1936, p. 137) calls 'animal spirits' in an environment where containment is relatively weak. Society encourages the 'spontaneous urge to action' (*ibid.*, p. 144) of entrepreneurs. At the other end of the spectrum is the technology management and organisational behaviour literatures in which key management practices (or rules and conventions) are imposed on economic and social conditions in a way that containment far outweighs contingency, resulting in continuous and incremental innovation. Human actions by agents at this end are strongly constrained by history, with the individual and institutional biographies derived from the past, but still within what Keynes called 'the entrepreneur economy' in which 'entrepreneurs' are compelled to make investment decisions (*ibid.*, p. 150).¹¹ Complexity allows the arbitrary typology of this simple C&C spectrum to be used in any real-world situation. For example, an initially constrained innovation can, over time, shift to the spontaneous end of the spectrum as society and its participants in entrepreneurial decision-making become more open in the systems employed.

Two major contributions are identified and examined in Oakley (2002) to the concept of novelty. These contributions by Young Back Choi and George Shackle can be grafted onto the C&C spectrum to derive an ontology of innovation. Choi (1993) recognises uncertainty as the stimulus for innovation.¹² Opportunities arise with the uncertainties of life ('disequilibria' in orthodox economics). Choi identifies the sources of these uncertainties as: (i) ontological complexities; (ii) unpredictability of the future; (iii) interdependence between agent and others; and

(iv) limitations of the mental capacities of agents.¹³ With such difficulties, any situation in which agents need to make a decision and act into the future requires a set of guidelines provided by a 'repertoire' of habits and routines established from the past. Choi calls these 'paradigms' that have evolved from experience. The more novel the situation, the more agents need to search for the most appropriate paradigm and then modify it to best address this situation. Innovation comes out of this process. This 'search and modify' behaviour can fit into the C&C spectrum by recognising the extent of contingency and containment in each decision. The more a paradigm is modified, the closer the agent is on the spontaneous end of the C&C spectrum.

The deeper ontological question that Choi's analysis brings forth is how 'search and modify' behaviour operates in a world of fundamental uncertainty to produce innovation. This behaviour cannot be based on any calculation of what is objectively probable, but instead on the subjectivity of what is deemed possible. This is the starting point for Shackle to explore the role of imagination in this 'search and modify' agency process. Shackle has published a significant body of work on the role of imagination, driven by inspiration, as the source of creative solutions (or simply, ideas) to the problem of fundamental uncertainty when it comes to making decisions into the future and acting on them. In the process of devising such inspirational solutions, novelty and innovation are introduced into the system. From this proposition, it is clear why the '... world in which enterprise is necessary and possible is a world of uncertainty' (Shackle 1967, p. 133). As Oakley (2002, p. 111) notes, 'For Shackle, the very existence of profit as capitalism's *raison d'être* stems from uncertainty manifested in expectations of value', where '... the differences between the value of a current stock of goods and their expected future value ... [are] subjectively assessed by the holding agent'.

Placing future time into a reasoned rational space through imagination, Shackle turns 'mechanical man' into 'inspired man', without giving up formalism. Shackle does this by identifying degrees of potential surprise that form a sequel in any contemplated course of decision and action. Oakley (2002) develops this account of Shackle's work in three detailed chapters. What Shackle contributes is a subjective (yet formal) process of innovation by handling uncertainty through the imagination. Shackle's weakness on the situational conditioning of agents (identified by Oakley) can be overcome by incorporating Choi's paradigms within the C&C spectrum. This then provides a thorough ontological theoretical construct from which to understand innovation and its diffusion.

For completeness, the diverse heterodox and professional contemporary literatures on innovation are briefly placed within this C&C construct. None of these sets of literature establishes any clear prior ontology that encapsulates the whole spectrum. Their own respective limited rationales situate innovation only on one part of the C&C spectrum.

At the extreme spontaneous end of the C&C spectrum exists the neo-Austrian literature (see Kirzner 1973), in which the entrepreneur is seen as alert to opportunities for taking advantage of discrepancies and gaps in the market system.¹⁴ In this sense, the neo-Austrian version of the entrepreneur is an arbitrager; a person embodying foresight, knowledge and willingness to act in situations of widespread ignorance of the disequilibria that exist (Canterbery 1995, p. 262). Exploiting opportunities in a rational planning manner adds to the value of the final product by the techniques that are 'put to use'. The appropriation of monopoly power in the market is evidence of creative and successful

entrepreneurship. Such monopoly power is not seen as permanent by neo-Austrians unless such power is underwritten, subsidised and otherwise supported by governments and their regulatory agencies. Shackle would feel comfortable within this body of literature, if not for him recognising that action of entrepreneurs must be situated within a social, conditioning and regularising environment. The entrepreneurship business literature is based on the same human agency rationale, but at the implementation ('how to do it') level. Not surprisingly, the role of containment (especially government) is seen as part of the exogenous environment rather than situated inside the agency ontology.¹⁵

At the other constrained extreme of the C&C spectrum exist the Institutional and neo-Schumpeterian literatures. Innovation in this approach comes from the 'technostructure' of the large corporations that form the planning system of capitalist economies and which guides economic development. This agency group embraces specialised knowledge, talent and experience (especially through R&D) in specific technology-based areas where the market system (and its small enterprises) is symbiotically subservient to the decisions of large corporations, while governments need to acquiesce to the planning system's power and influence. This exemplifies a highly constrained innovation process. John Kenneth Galbraith (1967) developed this large firm dominance approach from Joseph Schumpeter (1942) with a managerial class that is concerned to protect and support increasingly sophisticated technology in a planned approach.¹⁶ Power lies with the technostructure that serves partly the capitalist-owners through share price and dividend sustainability, with increasingly generous serving to themselves via remuneration packages and perquisites of office.

The mainstream business management literature is compatible with the Institutional approach, but with a microeconomic perspective of the firm as an administrative unit that develops a 'life' of its own and is not distinguished from the actors who operate inside this organisation. Edith Penrose (1959) is the major inspiration for this perspective.¹⁷ The focus is on the firm's internal development through a dynamic capabilities framework. In this approach, it is human agency itself that gets sublimated under the coordination of core competencies. The human agency rationale at the management level remains essentially *homo oeconomicus* as explained above. At the level of the general employees in an organisation, Teresa Amabile (1988, p. 55) addresses the ability of workers to be creative by asserting '... do what you love and love what you do'. This creativity comes from internal motivation to engage in rewarding and challenging work, which is cultivated through organisational creativity management. Locked into the containment end of C&C is the ability of agents to be creative and take the innovation through to implementation. However, this can only be seen as exogenous, i.e., internal motivation comes from outside the research 'model'. It follows that the problem with the management literature is its inability to endogenise useful observations about capitalism's *raison d'être* in matching expectations with time-bounded uncertainty.

A new set of innovation literature based on the notion of the 'Creative Class' provides a more complex problem for the C&C ontological construct. The major theoretical and empirical work is based on Richard Florida (2002), who identifies innovation in the creativity of an élite class of talented individuals. The élite prefer places that are diverse, tolerant and open to new ideas. Such regions develop effective, speedy and concentrated flows of knowledge, which Florida calls 'creative capital', as it is the prime asset in the region's economic development.

Entrepreneurship and business development are attracted by these *élite*. Regions throughout developed economies are promoting themselves as centres with a particular unique blend of creative capital, but its diffusion quickly dissipates over distance significantly limiting the spillover effects to nearby regions. The creative *élite* are at the spontaneous end of the C&C spectrum, and are attracted by a broad set of social and cultural conditions that reside within specific geographic boundaries. This makes the creative *élite* highly contingent on what attracts them to the region, yet the *élite* themselves create the innovative environment. There is an ontological problem in having regional development authorities searching for and supporting this *élite* when it is this very *élite* that creates the appropriate environment. Regional policies based on attracting and retaining this *élite* need to develop a ‘containment’ environment that works against the *élite*’s own predilections and is exogenous to their own creativity. Also, the footloose nature of the *élite* implies that another region may find it easy to ‘poach’ such highly prized individuals.¹⁸

Overall, the C&C spectrum provides a way of understanding innovation across the whole breadth of innovation forms. It also indicates the specific ontological limitations of various approaches to innovation proffered by scholars from different research disciplines.¹⁹ The remaining sections of this paper examine how this ontological account of innovation can provide a sound basis for exploring the endogenous paths of economic development that innovation has the potential to create. This development path accords with Oakley’s scholarly concern for Adolph Lowe’s political economics.

5 The Human Agency Path through Innovation

The move forward from the ontological exposition of innovation above to a realist human enquiry into the various aspects of innovation identified in the diverse sets of innovation literatures requires revelation of the human agency path. Oakley (2002, pp. 6-7) explains that ‘... full appreciation of the reality around us requires us to adopt a “three-level” perspective on how it is structured and grasped’.²⁰ This section adopts Oakley’s three levels, namely mental approach, procedural rationality and situational analysis, to appreciate the structure of the human agency path of innovation and progress through it.

The path begins where human action is ‘... conceived of as a self-conscious, subjective and cognitive being’ (Oakley 2002, p. 9). The realist ontology specified earlier rejects the *homo oeconomicus* instrumentalist psychology. In its place Oakley substitutes ‘folk psychology’ of thoughts shaped by agents’ mental makeup.²¹ It is here that ideas are formulated. For innovation, at the cognitive level there are specific mental qualities, dispositions, intentions and purposes that are reflected in the characteristics of entrepreneurship discussed earlier. Out of the ‘endless list’ that can be made up of these characteristics, Michael Schaper and Thierry Volery (2004, p. 36) identify three valid traits: (i) a need for achievement; (ii) an internal locus of control;²² and (iii) a risk-taking propensity. These traits are inevitably subjective and can never be reduced to objective elements of the physical sciences type. The three traits provide the pre-existing cognitive qualities that allow sensory data to be processed so that opportunities for innovation can be identified. For Oakley (1994, fn. 19), this ‘... demands a significant degree of creativity and independent insight on the part of the agent, as well as a deep knowledge of existing and potential future production techniques and/or product outputs’. Agents

with a strong concentration of the three traits develop a strategic sequence of proposed actions that are resource-using while incurring both sunk and transaction costs. Examples of such *ex ante* decisions and actions in the innovation field are R&D, education and training, technological management, new product marketing and, crucially, investment in new capital goods.

At the second level, the omnipotent optimising (substantive) rationality of *homo oeconomicus* is replaced by procedural rationality. Alessandro Vercelli (1998) argues cogently from first principles that fundamental uncertainty makes any optimisation algorithm based on substantive rationality impossible to express in any way that would have operational significance. The elements of irreversibility and complexity that arise over historical time imply that an adaptive procedural rationality is required.²³ This means that creativity and innovation can only be achieved in a cumulative process of learning by doing and acquiring knowledge through implementation of acceptable adaptive (non-optimal) conventions and rules. The crucial aspect of this rationality is that innovation is a contingent process that achieves outcomes ‘... that cannot fully realize any imposed notion of an optimum’ (Oakley 2002, p. 168). Innovation is a risk related to changing a product, process or organisation (or introducing a new movement or opening up a new raw material source), which is a matter of fundamental uncertainty and is different from the chance-type financial risk of capitalists when speculating, lending or gambling.²⁴

Situational analysis is the final perspective level that folds into the previous two levels. Here, the ‘free-to-choose’ market situation must be replaced with an *in situ* action process where autonomy is counterbalanced by contingent containment. Autonomous subjectivism of Austrian economics needs to be weighed up against Marxist determinism. In the innovation process, the opportunities and options that confront the entrepreneur are bounded by the folk psychology of the entrepreneur and the particular procedural steps she/he takes, as well as the actions of other agents in response to the same opportunities and the initial actions of the original entrepreneur. All this is bounded by the specific institutions and political frameworks that influence the development of any particular innovation.²⁵ Often it is the second or third entrepreneur who follows the initial entrepreneur in the same innovation process that succeeds in the long-term diffusion of the innovation.²⁶ Also, sometimes innovations (and creative ideas) appear independently of each other around the same time because the *in situ* action process is very similar, with the first two levels of this agency path being congruent.²⁷ The above *in situ* circumstances narrow the possibilities from which innovation is ‘chosen’ and shapes the mentality of the participants in the innovation process and its diffusion.

6 The Traverse in the Political Economics of Innovation

Enhancement of innovation has become the quintessential feature of commercial, political, economic and business life. However, the diverse views and applications of the term innovation have shown very little understanding of what innovation is all about and how best to enhance its processes for the common good. This section will take the ontological novelty-based human agency path of innovation as the fundamental sequential process (or traverse) and develop a coherent systems approach to innovation policy for public and private sectors within capitalism. The result is a comprehensive political economic intervention that enhances innovation systems within a particular geographical boundary that demarcates a domain which

may be sub-national regional, national, cross-country regional or even global (in terms of, for example, greenhouse emission protocols).

The *observed* traverse is defined as a sequence of irreversible events within the structure of production. These events are changes that occur (or are induced by policy) to alter the level of demand or supply in the economy at a macro level. In response, these changes lead to a sequence of slowly evolving production decisions made by industries and firms. An innovation that changes the structure of production generates an observed traverse. This traverse requires empirical analysis, both from the perspective of a change in agent behaviour and the strategies and processes that generate the traverse path. Radical innovation is major change that alters significantly the traverse path. Incremental innovation is minor change that supports and enhances the current traverse path.

Our realist ontological analysis shows that innovation does not come 'out of thin air'. The previous section identified the complex *in situ* human agency path of innovation. Thus, innovation is contingent on this path, which includes the institutional and political frameworks of the specified geographical boundary under consideration. *All* innovations come out of a subjective contingency that is tractable in a complexity-type process. Intervention in the economics of innovation is highly commercial (e.g., Bill Gates monopolising information technology) and political (e.g., warfare needs for military technology). The task of the political economy of innovation is to devise policy-induced interventions that serve the broader community and not purely the interests of powerful commercial interests and their political supporters.

Lowe set himself the task to develop an *instrumental* traverse that is a policy-designed trajectory which is based on specific end-target goals. Lowe considered that these goals must be determined by grassroots support (voluntary conformity) and have the supporting systems and 'instruments' to deliver what is demand-determined. This strategy needs a carefully designed adjustment process with targets for each stage of the traverse to be supported by investment perspective planning as set out by Kalecki. This Lowe–Kalecki planning framework provides the instrumental policy approach for the political economics of innovation incorporating the three-level human agency perspective. This planning framework can transcend the C&C spectrum in a particular administrative region.

Lowe (1976) established an instrumental analytical framework designed to enable rules of formal behavioural logic to be applied to economic cause and effect sequences over historical time. This framework is particularly aimed at using such cause-effect principles to communicate to agents concerned about the goal-directed outcomes desired. Agents who want to be involved in contingent entrepreneurial activity need to convert these 'control design' principles, developed through innovation, into behaviour and actions that 'add-up' to the desired macro outcomes. For Lowe, the patterns of conduct for innovative agents need to deliver a sustainable, equitable and ecologically supportive economic environment.²⁸ Once the desired patterns have been identified, it is critical to ensure that communication and implementation requirements are accurate and effective. This approach directly addresses innovation through the contingent folk psychology in the human agency path. Thus, the ideas that will be generated through this economic genotype can be more conducive to desired patterns (e.g., ecological sustainability) rather than undesired patterns (e.g., speculative and predator activities like corruption, fraud and destruction of the ecosystem).

Procedural rationality is needed to ‘handle’ fundamental uncertainty that inevitably will confront innovation in the future pattern of desired conduct. Analysis and evidence show that uncertainty through innovation by the short-term myopia of the ‘mistake-ridden private sector’ causes investment instability, thus undermining economic activity and competitive advantage (Courvisanos 1996, pp. 190-2).²⁹ The private corporate investment strategy that is best suited to innovation needs a secure business environment, but one that has public policies which support continuous development and change (see Kay 1993). This situation potentially offers an opportunity (via containment) to direct agency-based innovation activities towards a sustainable outcome. In market-based economic regions or nations that lack relevant supportive physical and social infrastructure, there is insufficient order and coherence (or containment) to impel the creation of innovative sustainable investment projects by the private sector without a state structural adjustment policy.

It is possible to link Lowe’s planning framework with a specific strategy for investment, through Kalecki’s (1986) ‘perspective planning’ approach. This approach to investment planning establishes motivation and voluntary conformity directed towards appropriate goals (e.g., ecologically sustainable economic growth). A path of dynamic diffusion of new technological and organisational systems needs to be established that is conducive to innovation for a sustainable physical environment. This requires long-term investment strategies to have an incrementally adjusting *perspective* planning approach.³⁰

To achieve this perspective plan, it is necessary to (a) establish specific practical short-term goals to (b) induce specific long-run sustainable rationality in contingency-based innovation, with (c) investment decisions that generate specific long-term goals. The plan must be continually assessed at every short-term endpoint to see whether it is necessary to revise the goals and the strategy for reaching the broad-based long-term scenario. A perspective plan with these goals is set up to form a specific investment programme in consort with agreed human agency rules that deliver the type of sustainability determined by Lowe’s ‘instrumental analysis’.

7 Conclusion

Innovation is central to the study of economics, both in terms of behavioural processes and economic development. If there is no innovation, society stagnates. Scarce resources can only be distributed more effectively by innovation, both organisationally and technologically. Yet, innovation remains poorly analysed and even more poorly modelled in the economic ‘science’. Major economic thinkers have placed innovation at the centre of their analysis (e.g., Smith, Marx, Schumpeter), and others have seen innovation as an important long-run development (e.g., Hayek, Kalecki, Lowe). A view that innovation cannot be modelled because its processes are complex, uncertain and therefore indeterminate has dominated economics. Innovation can only be seen *a posteriori*, and this inductivity is unacceptable to economists who see their ‘positivist science’ as deductivist and objective. In effect, this approach accepts the current economic phenotype and merely attempts to optimise economic efficiency of such a realised economic system.

This paper adopts the Oakley human agency analysis to show how a reconstruction of economic theory using a realist ontology can be applied to develop a model of innovation decision-making and action. Oakley models human

action by capturing the balance between contingency and containment. This provides the basis for understanding the wide gamut of entrepreneurial activity that can be seen as innovation; from strongly contingent to heavily contained. A three-level perspective of the human agency path (mental approach, procedural rationality, situational analysis) provides an approach to modelling an agent's innovation process. Once this path is appreciated, then Lowe's instrumental analysis can be adopted to transcend the contingency/containment spectrum by seeking the cooperation of entrepreneurs and other agents in the path of innovation and its diffusion towards generally accepted economic goals. This approach recognises the limitless potentialities of novelty within the economic genotype. It also uses the institutional structures available to alter the preference ordering of economic agents so that the imagination can be focused on innovations that can produce a set of techniques for acceptable goals like ecological sustainability. The Kaleckian perspective planning of investment can be used to support and guide this innovation strategy. With such a process model, the innovation issues and policy debates around what sort of society we want in the future becomes a realist ontological necessity.

Economists need to see agents of change as operating in a messy world of contingency and uncertainty in which agents use bounded rationality to satisfice behaviour in a complexity-based world. The science of complexity allows an investigation of innovation as an open system in which the collective behaviour of many basic but interacting units evolve over time, with self-organisation and adaptation.³¹ A formal process of innovation by handling uncertainty through the imagination allows economists not only to appreciate the novelty of innovation, but also to identify systemic failures. In this way, government intervention can be developed to induce entrepreneurial action in an equitable and effective manner.

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Notes

1 Kalecki (1954, p. 158) identifies such phenomena as making '... necessary new investment in productive and transportation facilities, etc.', and as such, stimulate economic activity.

2 For example, in chronological order, these include: Landes (1970), Rosenberg (1976), von Hippel (1988), Freeman and Soete (1997). Many more exist. Quite a few are listed and discussed in Freeman and Soete (1997).

3 This fiction is represented by the identification in the business press of financial incentive as a return for uncertainty, when in fact it is a pure gambling exploit (see Strange 1986).

4 The appropriate quote from Kalecki (1968, p. 263) is: '... the long-run trend is only a slowly changing component of a chain of short-period situations; it has no independent entity'.

5 'I should have ...' is pointless, 'I can learn from this ...' is a useful addition to a person's biography.

6 Both examples of chess (closed system) and children's games (open system) are provided by Oakley (2002, p. 209).

7 Oakley (2002) acknowledges the work of Anthony Giddens in identifying this C&C spectrum.

8 For a detailed exposition, see Forstater (1999).

9 Over the last fifteen years, the entrepreneurship discipline has developed much empirical research on the characteristics that make up an entrepreneur who introduces novelty into an economic activity. Despite this effort (and its reproduction *ad nauseam* in textbooks), Storey (2000, p. 137) comments that '... the identikit picture of the entrepreneur whose business is likely to grow is extremely fuzzy'. The management of technological innovation literature has developed a long case study tradition in this aspect of strategic innovation that is led by Chandler (1990) and more recently supporting this with quantitative measures of change (Ettlie 2000). As professional guides to strategic management this literature has provided a powerful framework for technological commercialisation (see, especially, Jolly 1998), but there is no ontological account of what drives this innovation. Organisational behaviour literature has argued strongly that innovation comes from engaging individuals in creative organisational climates that influence and support creativity, especially in terms of continuous innovation (Amabile 1997). Establishing an environment (or climate) that employees love to work within provides support for creativity but does not explain the motivation for such creativity.

10 Oakley (2002) does not investigate the notion of novelty itself. The aim of this paper is to use the C&C spectrum developed in Oakley (2002) to elucidate ontology of innovation by locating various writers on innovation across the C&C spectrum and then integrating this analysis to transcend any simplistic taxonomy of innovation-based writings.

11 This C&C spectrum resolves the problem of using the term 'entrepreneur' in two distinct ways. The entrepreneurship literature assumes all entrepreneurs are on the spontaneous end of the spectrum, whereas the Post-Keynesian literature assumes all entrepreneurs make investment decisions in the creation of new plant and equipment from profits. Such investment decisions are implicated throughout the spectrum, with the nature of this investment reflecting the form of innovation undertaken (see Courvisanos 2003).

12 This is in stark contrast to the ostensibly financial incentive (or greed) of *homo oeconomicus*, which has been ontologically rejected earlier in this discussion (see Note 3).

13 Adapted from Oakley (2002, p. 31, fn. 3).

14 Consistent with this view is Schumpeter's first analysis in 1911. He identified the entrepreneurial process in terms of the small capitalist who drives new ideas into the market place while destroying old products and processes ('creative destruction', Schumpeter 1934), and this seemed to be consistent with the form of capitalism observed by economists through the nineteenth century. The innovative activity is seen to be exogenous to the firm (especially the characteristics of the entrepreneur), in what has been referred to as Schumpeter Mark I.

15 As a result, the textbooks on entrepreneurship ignore totally the role of government and they play scant attention to the creativity environment that can nurture innovation (see, for example, Kuratko and Hodgetts 2004).

16 By the early 1940s, Schumpeter recognised the institutionalisation of R&D in sustaining the monopoly power of large corporations to the point that he was concerned that this process would see the end of the entrepreneur as R&D became a purely bureaucratic activity (Schumpeter 1942). This raised the spectre of Schumpeter Mark II

with 'creative accumulation' from minor incremental innovative activity that is endogenous to the large corporation.

17 A significant contribution to this perspective by economists working in this field is Dosi *et al.* (2000).

18 Empirical and policy critiques of this 'Creative Class' literature have been cogently developed. For an outline of these critiques see Rainnie (2005).

19 This discussion examines writers on novelty from the ontological criterion only. For a broader examination of this work on novelty, taking account of methodological and metaphorical criterion, see Hodgson (1999, p. 135).

20 Oakley (2002, p. 6) calls this 'transcendental realism'. It is based on mechanisms of structure, rules and power that generate events and states of affairs.

21 Oakley identifies Karl Popper at the self-identity mental level (Popper and Eccles 1977) and George Shackle at the economic actions level (Shackle 1972) as major contributors to this concept of folk psychology.

22 In the entrepreneurship literature, this refers to the personal ability of the entrepreneur to take control of situations.

23 Oakley identifies Herbert Simon as the major contributor to the concept of procedural rationality in many of his writings (see, for example, Simon 1976).

24 On the specific procedural rational steps that need to be followed by an entrepreneur when conducting an innovation process, see Legge and Hindle (2004, pp. 161-88).

25 For example, the innovation path of military technology is heavily circumscribed by the particular needs of warfare, from Spartan hoplite to US stealth bombers. Jones (1987) explains these processes.

26 Legge and Hindle (2004, pp. 74-6) call this the ecological model of innovation, where an initial inventor or researcher 'discovers' a logical relationship or a physical phenomenon that seems to have limited practical applications. The broader innovation applications are provided by the initial entrepreneur (or 'intrapreneur' in a large corporation), but it is the other entrepreneurs who follow and diffuse the innovation who create the larger market possibilities. For example, Henry Ford's Model T Ford introduced in 1908 was the start of the great technological thrust of mass-motor vehicle market, but it was General Motors and Alfred Sloan (and then many other motor vehicle companies with minor innovations) that made the motor vehicle ubiquitous.

27 Some examples of simultaneous discoveries are food canning (Appert [France] and Donkin [Britain]), aluminium smelting (Hall [USA] and Héroult [France]), counter-cyclical government macroeconomic policy (Keynes [Britain], Kalecki [Poland] and Lundberg/Lindahl [Sweden]).

28 See Courvisanos (2005) for a full account of this ecologically sustainable innovation policy framework.

29 See also Richardson (1960) for details on lack of coordination in markets for investment and the systemic failures that this creates. Richardson goes on to specify how investment coordination through information agreements and industrial concentration can assist in developing micro-goals in policy-oriented strategies.

30 Vercelli (1998, p. 274), in his conclusion, explains why long-term goals need to be established:

One of the main reasons for the deterioration of environmental problems may be ascribed precisely to the myopia of economic agents increasingly obsessed by very short-run objectives. Short-run rationality produces a profound irrationality in the longer run. Only a broader long-run rationality may produce a process of sustainable development avoiding deep regrets.

31 Courvisanos and Richardson (2006) show how unstable economies operate, not in a purely chaotic environment, but within a 'corridor of viability' that limits instability.

It is manipulation through containment that the corridor can direct contingency, inherent in instability, on a traverse path of sustainable rather than unsustainable development.

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