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# Learning-by-doing: an insight worthy of the pantheon and how to do it in teams

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## Abstract

In this paper, I pick up on an important theme in Mario Rizzo's work: that rationality should be understood more broadly than the rational choice model as learning to adjust behaviour in the light of experience and the mistakes that it yields. In particular, I focus on learning-by-doing (LBD). I argue in the first part of the paper that it should be regarded as one of the central insights in economics, alongside those that are more usually recognised like the gains from trade and the importance of unintended consequences. I use Smith and Hirschman's discussion of LBD to ground this claim. In the second part of the paper, I turn to the determinants of LBD in teams. I argue that the key rule or constitutional/policy design question is how best to embrace the diversity that is central to LBD within teams without this undermining the social origins of co-operation in teams.

**Keywords:** diversity; learning-by-doing; teams; rra; rationality

## Introduction

Like many Austrians (and Post Keynesians), Mario Rizzo often argues that learning is constitutive, not exclusively, but importantly so, of what it means to be rational. And, so it must be. Adaptation to environmental change is what secures survival of any species and adaptation in humans depends in large measure on learning (e.g. Knight, 1921). Learning has two broad domains. One concerns the connection between our actions and outcome. This is often uncertain (and not just risky). The other is how to value outcomes. This, too, is often uncertain because our preferences/evaluative standards can be incomplete and/or provisional. Thus, to engage rationally in action that is valued requires (a) learning about rules of decision making that are suited to a particular environment because they connect actions to outcomes more or less predictably and (b) learning how to judge outcomes. These are two different types of learning, but they share a common feature: to learn about the world or about one's possible self, one has

to have some new information, input or consideration about the task in hand. It can be a new action, where, as Rizzo would say (e.g. Rizzo and Whitman, 2020: p. 115 and 210), there is scope for error and feedback of the unexpected; or it could be a new way of thinking about a problem. The ‘doing’, in other words, can be liberally understood. It has, however, to be doing something new if it is going to yield information from which people learn. This is a paper about such ‘learning-by-doing something new’ (LBD, hereafter).

I make two arguments about LBD. First, in the ‘LBD: a candidate for the pantheon’ section, I claim that LBD is one of the central insights in economics. It deserves a place in the economics pantheon along with the more famous insights like the gains from trade, unintended consequences and the coordinating properties of markets. Another way of saying this is that ‘entrepreneurship’, as understood by Knight (1921), deserves a place in the pantheon. Knight identified in his famous 1921 book that the practical limits of knowledge yield a distinction between risk which is knowable in a probabilistic sense and uncertainty which is not. The exercise of entrepreneurship for Knight is how these limits to knowledge when there is uncertainty are overcome in practice. Entrepreneurship is a blanket term for how we overcome ignorance in this sense and so it is natural to cast this skill or capacity with an advance in knowledge. I take this to be one of Harper’s (1996) points about entrepreneurship. Mainstream economics (i.e. the kind of economics that has a pantheon) notoriously has little to say about entrepreneurship. However, when entrepreneurship is understood as advancing knowledge, economics has periodically, starting with Smith, drawn one very important insight regarding how knowledge advances: it is through LBD.

Second, in the ‘LBD (or entrepreneurship) in teams’ section, I consider some of what we know, in part from experiments, about such LBD in teams. This is important because, as Rizzo has often noted (e.g. Rizzo and Whitman, 2020: p. 214) much learning in society takes place in teams. As a result, entrepreneurship in society depends in large measure on how well teams learn. I argue that teams face a key problem: how to embrace the diversity within the team that is central to LBD in the team without this diversity undermining the social origins of co-operation within a team that are also necessary for LBD within teams. This is ultimately a familiar political problem with respect to how to design institutions where people who are fundamentally different nevertheless manage to get along with each other. As a result, my proposals for team organisation draw largely on the political theory of how to construct a functioning pluralism. To avoid any misunderstanding that these proposals are a challenge to Rizzo’s suspicions regarding state-like interventions, I make clear now, from the start, so to speak, that these proposals are constitutional. That is, they deal with the rules governing social interaction i.e. a constitution-like policy question and not a policy driven by a concern to generate particular outcomes. All liberal societies depend on such rules of the game.

## **LBD: a candidate for the pantheon**

### *LBD and productivity growth*

One might have thought that LBD was assured a place in the pantheon because of its role in Adam Smith’s account of the wealth of nations. LBD explains in part why

specialisation through a division of labour promotes productivity growth and this is a key element in what we now call his endogenous theory of growth linking the extent of the division of labour with the size of the market. The one potentially fuels the other in a process of cumulative or self-reinforcing growth. LBD has since featured in many accounts of growth: e.g. Arrow (1962) and Romer (1986). Arrow is a particularly useful and a suitably authoritative source for my argument. So, I will say a bit more about his account.

Arrow's contribution comes at a time when the conventional wisdom in neoclassical growth theory (largely due to Solow, e.g. Solow, 1957) was that productivity growth in the long run depends on advances in knowledge and the associated technological changes in the aggregate production function. Thus, when Arrow writes his famous 1962 article, he focuses on how knowledge advances: i.e. how people learn new things about the world. In this context, he makes the first of his useful observations for the purposes of my argument: it concerns the way that learning comes from doing. The second is that substantive learning does not come from mere repetition, it comes from new experiences: i.e. doing something new. This is how he makes these two points.

Of course, psychologists are no more in agreement than economists, and there are sharp differences of opinion about the processes of learning. But one empirical generalization is so clear that all schools of thought must accept it, although they interpret it in different fashions: Learning is the product of experience. Learning can only take place through the attempt to solve a problem and therefore only takes place during activity. Even the Gestalt and other field theorists, who stress the role of insight in the solution of problems (Kohler's famous apes), have to assign a significant role to previous experiences in modifying the individual's perception.

A second generalization that can be gleaned from many of the classic learning experiments is that learning associated with repetition of essentially the same problem is subject to sharply diminishing returns. There is an equilibrium response pattern for any given stimulus, towards which the behaviour of the learner tends with repetition. To have steadily increasing performance, then, implies that the stimulus situations must themselves be steadily evolving rather than merely repeating. (Arrow, 1962, p. 155–156)

No more need be said, I suggest, for why my combination of these two points in the phrase, 'learning-by-doing something new', is of central importance to economics. It holds the key to growth.

In fact, Arrow, like his later follower in this vein, Romer (1986), did not pick up on Smith's chapter 1 application of the division of labour to the production of knowledge itself. Smith's seminal argument ought to have set the stage for an analysis of team production among knowledge workers. It did not and I attempt a small gesture of rectification of this omission in the 'LBD (or entrepreneurship) in teams' section of this paper.

Instead, Arrow makes the history of gross investment an index of the new experiences garnered over time through LBD; and this becomes the source of productivity

growth in his model. This is perhaps understandable at the time because it fitted well with some of the then stylised facts of growth: e.g. Veerdoon's law and the famous interwar studies of learning curves in the production of aircraft (see Veerdoon, 1956, and Wright, 1936). This dependence of learning on investment is a significant difference from the approach suggested by Smith, and not least because it enables Arrow to solve his model with a very early use of rational expectations. People need only hold model correct expectations about the future levels of equilibrium investment because this holds the key to how experience will grow and with it productivity. This is, however, in an important sense, a slight of hand because it has made the growth of knowledge predictable. Knowledge is not like that.

The growth of knowledge is, instead, always in some degree uncertain and unpredictable. It is a feature of knowledge that any change in it cannot be fully anticipated, even probabilistically – otherwise it is not really a change in knowledge. As Humphrey Lyttleton famously remarked 'If I knew where jazz was going, I'd be there now' – in other words, there would, in fact, be no change in knowledge. Or to put this slightly differently, one cannot know what the value of new knowledge might be until one actually has it. And even then, its value, may depend critically on future knowledge developments which cannot be known now. This is one reason for the unpredictability of LBD. The other is that much LBD takes place with respect to tacit knowledge (see Rizzo and Dold, 2021).

This unpredictability has two important consequences, one of which Arrow infers, but from a different route. This is that growth of knowledge has positive spillovers/externalities and so private investment will likely be below the social optimum. This arises in Arrow's model, if I have understood correctly, because knowledge depends on aggregate gross investment and any individual firm's contribution to this aggregate is small. From the perspective, however, of the way that knowledge growth is uncertain, the same conclusion is derived but more simply. It is that you cannot patent all the future changes in knowledge. This is a consequence of the fact that they are to some degree unknowable in advance. These gaps in any patent are how externalities arise: some growth in knowledge becomes freely available through those gaps.

The second consequence of the growth in knowledge being uncertain is that it depends on entrepreneurial decision making (or is animated by something other than rational instrumental calculation as when Keynes refers to the role of 'animal spirits' or 'unconscious induction' in the words of Knight, see Rizzo and Dold, 2021). Arrow, for obvious reasons, does not develop this thought because he has solved the future problem through model consistent expectations. Nevertheless, it is an important observation because it means that growth depends on something, entrepreneurship, about which economists in the mainstream have had little if anything to say. To illustrate this lacuna without the need for an elaborate or extensive argument, consider this: when was the last time that a report on the contemporary slowdown in productivity growth in most Organization for Economic Cooperation and Development (OECD) countries over the last 30–40 yr identified waning entrepreneurship or flagging animal spirits? The answer, to the best of my knowledge, is never. If, however, LBD is crucial to growth and LBD is another name for entrepreneurship, then isn't this a bit strange? This strangeness is a simple indicator of how something important has been lost by not taking as seriously as we should the importance of LBD.

There is more to say on behalf of LBD in the case for its inclusion in the pantheon of economic ideas. I make no claim to be exhaustive in this. I have deliberately started with productivity growth and LBD because this would seem incontestably important. Indeed, it is a matter of key contemporary public policy concern and would, for the reasons sketched above, be an obvious area for the development of behavioural public policy. I make the comment in passing. What follows are some further illustrations to drive home the point of this section: LBD deserves a place in the pantheon. However, before doing this, a further comment is worth making on the domain or the conception of LBD in my argument and how it contrasts with how LBD and its relation to productivity is discussed in the contemporary economics literature.

Thompson (2010) provides a useful survey of the economics literature on LBD in this respect. It is instructive in revealing how LBD has been neglected or underappreciated in economics. First, it identifies Arrow as the first occasion when LBD enters the economics literature. It notes that, in the discussions of education, it featured earlier but there is, for example, no mention of Smith. Second, it casts the domain of LBD very narrowly. This is not unrelated to the omission of Smith in this historical account. In particular, this literature associates the influence of LBD with evidence on how the unit costs of producing something declines with the growing experience in its production. The early famous case of this inverse relation was in the production of aircraft (see Wright, 1936) and, in the later examination of such evidence, economists have come to see the influence of LBD in this relation as more restricted. This is because the fall in unit costs often comes also from capital deepening or investments in R&D that produce new technologies. The point, however, about Smith's more expansive understanding of where LBD occurs, is that neither the process of new knowledge generation through R&D nor probably the application of capital deepening can be isolated from the operation of LBD. LBD is, for example, crucial to the activity of generating new knowledge/techniques through R&D activities.

### *LBD and path dependence*

My second case for the inclusion of LBD in the pantheon is that LBD alerts us to path dependence in economic outcomes: e.g. in the explanation of how economics acquire comparative advantage in trade and why we observe hysteresis in unemployment rates (see Hargreaves Heap, 1980, on the latter). This, in turn, helps explain many policies adopted by governments: e.g. respectively, to acquire comparative advantage through protection and to avoid skill atrophy among the unemployed through the proliferation of activist labour market and training policies in many countries after the early 1980s recession. Adam Smith gives a further illustration of path dependence when discussing why wage rates differ in chapter 2 of *The Wealth of Nations*.

The difference of natural talents in different men, is, in reality, much less than we are aware of; and the very different genius which appears to distinguish men of different professions, when grown up to maturity, is not upon many occasions so much the cause, as the effect of the division of labour. The difference between the most dissimilar characters, between a philosopher and a common street porter, for example, seems to arise not so much from nature, as from habit, custom, and education.

In other words, it is the sequence of historical decisions driven by habit, custom and especially around education, often made by others when a person is young, and then the actual course of the division of labour, that explain wage differences and not differences in natural talents. Second, and following from this, such path dependence gives economic outcomes a serendipitous quality. A small or chance difference in initial conditions can become magnified. Hirschman (1967) famously makes just this point, using the insight that comes from LBD and our psychologically informed blundering about, when advancing the idea of a 'hidden hand'. This is where we do things that we wish we had not. This is our psychological fate. But, fortunately, the ingenuity born of LBD sees us through what would otherwise be a bad experience.

This path dependence also potentially puts a new item on the normative agenda of economics. What, if anything, should we do, normatively speaking, about the fact that many economic outcomes are serendipitous in this sense? On the one hand, Hayek, who was much exercised by this question, was clear that this was the nature of the market game and we should accept it (i.e. we should do nothing).

The element of luck is as inseparable from the operation of the market as the element of skill. There is no need morally to justify specific distributions (of income or wealth) which have not been brought about deliberately but are the outcome of a game that is played because it improves the chances of all. (Hayek, 1982: p. 117)

He railed against those who imagined that social justice demanded that we do something about it. This was a legacy of our tribal sentiments and it was not suited to the Great Society constituted around markets and the exercise of liberty (see Hayek, 1960). We needed to lose the tribal habit. On the other hand, and to give the observation another timely flavour, much recent experimental evidence would suggest that people's willingness to compensate others for their misfortunes rather than their foreseeable actions is strong (e.g. see Cappelen *et al.*, 2013). This evidence has given succour to the argument of luck egalitarians like Dworkin (2000), Cohen (1989), and Roemer (1994). Hayek or Hayekians like Rizzo may not like it, but this dispute is on the normative agenda of economics; and it is there because LBD is important.

### *LBD and positive vs negative-sum thinking*

I will mention two further ways in which LBD contributes distinctively to economic ideas/insights. First, there is, perhaps, no bigger general idea or cultural contribution that economics gives to social life than that of positive-sum thinking. It is one of Adam Smith's great gifts when arguing against the zero-sum perspective of mercantilism (see Chinoy *et al.*, 2023, on the contemporary relevance of zero-sum thinking). The push away from zero-sum thinking comes from Smith, in part, through his analysis of the market and the invisible hand. This strand in his argument has been refracted in modern economics as a point about the mutual benefits that arise when people with different tastes or talents are free to trade with each other. Exchange in these circumstances is positive-sum and not a zero one. However, it is really his analysis of the origins of growth in LBD that gives the big boost to positive-sum thinking. There is no bigger fillip to positive-sum thinking than the experience of continuously growing

living standards. This, though, returns the argument to a point that has already been made about LBD and growth. Instead, I want to marshal a further distinctive argument from Hirschman (1984) on LBD and positive-sum thinking.

Hirschman (1984) is concerned with the way that economics as a discipline misleads itself through its drive to parsimony (the ‘beauty’, elegance and tractability that comes from simple models); and he wants to introduce a variety of complications. The one that concerns me is directed at the characterisation of economics as essentially about choice in the presence of scarcity. This characterisation of the task of decision making reinforces zero-sum thinking in the sense that a person must decide in the presence of scarcity. At the margin of decision making, a gain of one product or service comes at the expense of another. This is what scarcity means. For Hirschman, though, this misses something distinctive about a key resource: ‘love’. It is not a scarce resource. (He uses ‘love’ as a shorthand for morality and civic spirit because he is engaging with Robertson’s (1956) claim that what the economist economises on is ‘love’ in this sense.)

We know instinctively that the supply of such resources as love or public spirit is not fixed or limited as may be the case for other factors of production. The analogy is faulty for two reasons: first of all, these are resources whose supply may well increase rather than decrease with use; second these resources do not remain intact if they stay unused; like the ability to speak a foreign language or to play the piano, these moral resources are likely to become depleted and to atrophy if *not* used (p. 93).

He goes on to make the connection that I want to LBD (and, in this instance it is worth remarking, the connection is to what is, in effect, the second type of learning that I began with: learning what to value).

In a first approximation, then, Robertson’s prescription appears to be founded on a confusion between the *use of a resource* and the *practice of an ability*. While human abilities and skills are valuable economic resources, most of them respond positively to practice, in a learning-by-doing manner, and negatively to nonpractice (p. 93–94).

The same observation was made much earlier by De Tocqueville when explaining how the practice of individual participation in local political decision-making fuels the distinctive civic virtues of a free society that he found in the US.

Municipal institutions constitute the strength of free nations. Town meetings are to liberty what primary schools are to science: they bring it within the people’s reach, they teach men how to use and enjoy it (De Tocqueville, 1835, volume 1, chapter 5).

J.S. Mill (1861) made a similar point and suggested what the psychological link might be between the participation in political decision making and the seeding of ‘love’ in Hirschman/Robertson’s sense. It was the way that being involved in making a collective decision (one that affected everyone in a community) necessarily shifted a person’s perspective from pure self-interest to a consideration of everyone’s interest in the decision.

### *LBD and the puzzle of why risk taking is rewarding*

My final observation regarding the importance of LBD concerns a common tacit assumption in economics: that a trade off exists between risk and return (I use the term risk here loosely, merely to connect to the literature; it could be uncertainty). This is, in part, an understandable product of risk averse preferences. However, for interior solutions, the production side of the economy needs to exhibit a similar trade off and the question is: why? Why should taking a risk prove productive on average? A similar question was once asked about why the application of capital is productive. One famous answer was that capital introduces ‘roundaboutness’ into the production process and ‘roundaboutness’ yields productivity gains (as in the metaphor of how trees grow over time). Interestingly, the same question about why taking a risky action is a potential source of productivity is rarely asked. Yet, it is important. If there were not such a trade off on the production side of the economy, then why would risk-averse people take risky actions?

The silence on this question suggests it is obvious to most people that risk taking is productive and needs no comment. However, an average productivity gain is not obviously a feature of risk *per se*; at least not in the same way, say, as the passage of time is for the growth of trees when appealing to roundaboutness as the source of capital’s productivity. For example, if I run across the road without looking, this is less risky than walking across the road without looking because, with less time spent on the road, I am less exposed to the danger of traffic. But, why might walking across the road be on average a more productive course of action? After all, it takes longer when I walk and whether I run or walk does not change the technical aspects of the problem because the dimensions of the road or the underlying frequency of traffic won’t change with my choice. The moment, though, risk arises specifically from doing something new, then, it becomes clear why risk-taking might in general yield productivity gains. Doing something new is risky and it potentially increases knowledge – and this is productive. In the crossing the road example, the scope for learning is greater when taking the extra risk by walking because more time is spent on the road. Who knows? One might learn to look and so avoid the traffic; and this is more likely when walking than running. This is LBD.<sup>1</sup>

### **LBD (or entrepreneurship) in teams**

In this section, I extend the analysis of LBD by considering how to organise this activity when it occurs through the collective efforts of those working in teams within organisations. In practice, much LBD goes on in such teams. It is a direct result of Adam Smith’s insight with respect to the division of labour when applied to knowledge production. In fact, one could say that much entrepreneurship occurs through the activities of such teams rather than the more ‘heroic’ kind of individual acts of entrepreneurship that are sometimes celebrated. So, it is important to know what might

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<sup>1</sup>There is an interesting psychology literature related to this point regarding how to learn how to avoid big mistakes. Is it best to develop a skill of avoiding error or a skill of being able to deal with error through feedback corrections? See, for instance, Metcalfe (2017) for a survey of the evidence that comes down on the side of error tolerance and correction feedback.



affect such entrepreneurship. Of course, LBD does not have to occur in teams. One can imagine and, indeed, see how the coordination of the different efforts that follow from such a division of labour occurs sometimes through market institutions and versions of private property rights and through the norms or customs that have developed in the institutions of science. Nevertheless, much LBD takes place in teams with the coordination of the varied individual efforts occurring through non-market institutions that exhibit aspects of command and control.

The question of how such teams should be organised to encourage fruitful LBD may seem to set my argument against the Rizzo and Austrian presumption against all forms of planning, but I am not convinced that it does. Both Rizzo and Hayek acknowledge that we collectively make decisions about the institutions, the rules, within which we make our individual decisions. Their argument against planning is against interventions that are designed to produce particular outcomes. Planning in this sense may be a fool's errand, nevertheless, we still have to make constitutional decisions and stand ready to amend and adjust the rules that guide our behaviour when the constitution is not fit for purpose.

When thinking about such rules, the natural starting point is the 'problem' or 'difficulty' that working in teams throws up. This is what the choice of rules is designed to ameliorate. The premise of my argument is that the essential 'problem' is how to manage diversity productively (see Olson *et al.*, 2007, for some empirical evidence in support of this premise).

The difficulty is this: on the one hand, there is surprising apparent agreement that diversity – whether it be cognitive diversity (Dold and Rizzo (2021), or diversity of skills (Tetlock and Gardner, 2015) or cultural/value diversity (Alesina and La Ferrara, 2005) – holds the key to solving new problems. On the other hand, diversity can be a source of dysfunctionality when it makes trust and co-operation within the team more difficult. It is impossible to write contracts that bind members of the team to work co-operatively together when the team is engaged in the production of new knowledge because the shape of any new knowledge cannot be predicted and so written into a contract. This is in the nature of knowledge production and, for this reason, knowledge teams must depend on trust and co-operation amongst themselves to a high degree for success. Thus, if diversity also diminishes the well springs of 'love' (to echo Hirschman's use of the term to describe such civic minded behaviour), then there is a 'problem': how do we ensure that people who are different manage to rub along in a co-operative enterprise?

It is useful, when thinking about this, to rehearse some of the reasons why diversity within a group may undermine trust and co-operation within it. I will mention three and draw, in turn, some insights regarding how desirable rules for the team might ameliorate these forms of dysfunctionality.

First, there are what are largely empirical arguments from Goodhart (2013), Collier (2018) and Kaufman (2018) which assert, usually in the context of discussions of immigration, that a diminution of trust and co-operation with an increase in diversity is a fact of social life. The evidence on this largely comes from studies on trust, both observational and experimental (e.g. see Putnam, 2007,; Hargreaves Heap and Zizzo, 2009) and it is taken as axiomatic that a lack of trust will translate into a lack of co-operation. Of course, whether there is such a connection or a feed through from levels of trust to levels of co-operation will depend on how the distinction between trust and

co-operation is understood. If it is found in the difference between a trust game and a public goods game, then the evidence that diversity weakens co-operation in public goods games/interactions is, in contrast, weak or non-existent (see the meta analyses of Bailliet *et al.* 2014a, 2014b). This is not surprising from a theoretical perspective because they are different games. This is the source of my first suggestion with respect to the possible characteristics of rules for successful LBD within teams.

1. Rules should, where possible, predispose individuals to see their relationship with other members of the team as a public goods interaction rather than a set of sequential bi-lateral relations where trust arises.

Collier (2018) offers an explanation of why diversity is likely to undermine trust. It turns on the way that people who are alike will be better able to anticipate what the other person will do because they are more secure in projecting from their own behaviour to that of others when the other person is like them. This seems plausible but it does not immediately mean that homogeneity yields higher trust because a homogenous population of selfish agents who project from their own selfish behaviours will not exhibit high levels of trust. To explain why people might trust each other in a homogenous population, there will have to be some fellow feeling that means that people are less selfish in the homogenous group. There is some evidence that homogenous populations have more of such fellow feeling than heterogeneous ones (e.g. Klor and Shayo, 2010; Rueda, 2018). However, ever since the famous Sherif (1956) Robber Cave experiment, it has been argued by psychologists that diverse groups can develop such fellow feeling when there is interaction and there are common projects. My second rule suggestion follows from this.

2. Rules should, where possible, build in a shared objective for team members.

Second, there is a different explanation of why more heterogeneous teams may be less effective in LBD.<sup>2</sup> Recall LBD is essentially an uncertain activity and as such it causes anxiety. Some anxiety of this kind is necessary if people are to enjoy feelings of self-efficacy and self-worth, but beyond a certain point people find that too much anxiety depletes their decision-making capacities and feelings of self-efficacy. The optimal level of anxiety that thus emerges will be different for different people and people will manage their LBD actions so as to achieve whatever is their optimal level of anxiety. Within this context, the crucial point about diverse teams is that they generate a source of anxiety for everyone in the team that is independent of the anxiety that comes from whatever are the uncertainty provoking LBD decisions that any person is actually making. This is because the contrasting beliefs of others in a diverse team are an inescapable, to some degree, challenge to one's own beliefs. To be in such a team is, in other words, to put yourself in a position of some anxiety because your own beliefs are explicitly or implicitly placed in some doubt. This anxiety is separate from the LBD actions that push out the frontier of knowledge. It is instead like a kind of background anxiety.

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<sup>2</sup>This model of entrepreneurial decision making is akin to Harper (1996) and is set out in more detail in Hargreaves Heap (2024).

This anxiety is absent in an homogenous team, and so, *ceteris paribus*, as individuals manage their risky LBD actions in the homogenous team, they will be willing to engage in more LBD that potentially pushes out their frontier of knowledge than the member of a diverse team who has already used some of their optimal level anxiety up by simply being in a diverse team. My third desirable characteristic for rules follows.

3. Rules should, where possible, avoid becoming an additional source of anxiety for individual team members.

Third, and what potentially makes the management of diversity difficult, is the fact that teams are a non-market organisational form for coordinating activities and as such they entail a set of power relations. Some people tell other people what to do, at least to some degree. This creates a difficulty for a diverse team which is not present in a homogenous one: what prevents whoever is in charge from using their power to favour their own viewpoint over that of others? This is often what corrodes co-operation in a team. It is when the rules of interaction and the power relations this creates encourage zero-sum rather than positive-sum thinking among the team members. Indeed, this problem may be magnified when the leader of a diverse team internalises Kant's famous identification of the political maxim of 'divide and rule'. This is the way I express the next desirable characteristic.

4. Rules should, where possible, make 'divide and rule' behaviour difficult.

The general problem of how to design institutions of collective decision that will enable people who are different to rub along together and specifically this last aspect of the problem, has been central to discussions in political theory. At least from the Federalist Papers onwards, it has underpinned the case for the US Constitution as a device that prevents the diversity of the US descending into a version of the pattern of medieval European warring states who dealt with diversity in a zero-sum manner. In this respect, the Constitution's famous checks and balances are designed to prevent any group exercising too much power over another with the result that zero-sum actions are difficult to enact. Political decisions are made when wide coalitions across the branches of government and between the States and the Federal government can be put together. Such expansive coalition building, precisely because it has to be inclusive, only takes place around positive-sum activities. An entrepreneurial team needs the equivalent in its operating rules. This is what '4.' means.

A team obviously cannot have a full-blown division of powers like the US Constitution. Nevertheless, there are some simple expedients that could have the same effect. For example, the rules could encode a form of rotating leaders drawn from within the team. This makes a divide and rule strategy by any individual or factional interest within the team when occupying a leadership role much less attractive to any individual or faction than it would otherwise be with more permanent leaders. This is because the period of the benefit from divide and rule for any one leader is time limited under such an arrangement and the person would be liable to retaliatory/reciprocal divide and rule strategies when not in the leadership role. Such rotation may seem rather far-fetched and impractical, but this was the way that many academic

departments preserved diversity. Of course, there was never complete or unconstrained rotation with everyone at some time finding it was their turn to occupy the Head of Department's office. Some people are just not very good managers and so rotation was within a constrained group. The principle of rotation was typically not corroded, at least in my experience, by this practical constraint that it did not in practice involve everyone.

De Tocqueville provides another essential ingredient in what it takes to hold a diverse group together: a fundamental equality of conditions. By this he means that people are treated in a way that gives them equal standing in a group. A rotation of leadership and rules that enable all individuals to participate in decision making (for a recent discussion, see Niemeyer *et al.*, 2024) can help with this. There was nothing better for De Tocqueville than the Town Hall meeting (as seen above): open to all, it is an embodiment of the commitment to equal respect (as well as more directly engendering civic virtues). University departments again provide an example of this in practice. They have traditionally relied on committee rather than executive decision making. Of course, it is time consuming and often irritating to listen to old Buggins on their all too familiar hobby horse, but co-operation requires such investment now and it only pays off much later.

There is a further powerful reason for erring on the side of having decision-making rules that involve everyone rather than the more traditional hierarchy of individual decision makers where the person above you in the hierarchy tells you what to do. It comes from '1.'. In the traditional hierarchical arrangement trust is at premium. There are set of bilateral relations in the model of line management. Trust therefore becomes crucial in such an arrangement, and diversity seems to undermine trust. In contrast, diversity does not undermine co-operation in public goods like interactions and by tending towards organisational forms where everyone participates in decision making that is binding on all, the team is turned into something more akin to a co-operative enterprise of a public goods sort than a sequence of person-to-person trusting relationships.

De Tocqueville was also worried that economic inequality might corrode the political equality that he regarded as the magical ingredient of US democracy. Essentially, this worry was for what has become a common concern that economic inequality will be leveraged into political inequality. Entrepreneurial teams should worry for the same reason. There are deeper reasons, though, why knowledge teams should be wary of inequality. Inequality seems only ever easily justified when it reflects differences in contribution. This is what the experimental evidence teaches us. The various contributions to knowledge production teams may be different but they are also, and importantly, difficult to identify (see earlier comments). As a result, any particular outcome will seem to team members to be much more a matter of luck than a consequence of some people being more talented or exercising more effort than others. Inequality of reward in these circumstances can only court a danger of seeming unfair and so weaken the typical team member's attachment to and identification with the team. This is not helpful for '2.'

A simple reward rule that would encode '2.' is one where a significant part of any individual's earnings comes from their share in a team performance fund that is based on the team's performance over longish time periods (for a recent study of the benefits

of this in teams, see Hamilton *et al.*, 2003). There might be small differences in any individual's share in these group earnings (e.g. for when they take over a stint as a team leader) and there might be differences in the individual component of person's earnings. The point is that the team earnings element reinforces a sense of common purpose (i.e. supports '2.') and the egalitarian character of the shares in turn reinforces the sense that team is essentially engaged in a public goods-like game (i.e. supports '1.'). The 'longish' part of this proposal reflects that fact that LBD is uncertain in its effects. There are lots of dead ends and failures to find anything useful. One should not expect success all the time and the rules should reflect this likelihood. Indeed, the team element of remuneration when based on performance over a longish period provides all team members with insurance against the short-term volatility of LBD and so responds to desiderata '3.'

There is another way of appreciating how a compressed earnings structure within a team contributes to removing anxiety (i.e. '3.'). In so far, as the compressed structure is understood to arise from the uncertain nature of LBD in teams, then it is not just that successful outcomes cannot be identified with particular individual contributions, it is also that failures cannot be forensically traced to particular people's contributions. Blame, as a result, is simply not what people in an uncertain activity like LBD get deeply involved in. The prospect of blame is a source of anxiety and it corrodes risk taking. So, if a compressed wage structure downplays blame, it is for this reason, too, a good thing.

## Conclusion

Entrepreneurship is often regarded as a black-box-like compendium of individual skills of unusual judgement in the presence of uncertainty. I suggest instead that entrepreneurship comes from the practice of LBD. Indeed, LBD is one of the most important insights that economics has given social science. It is rarely acknowledged as such. Yet, it deserves a place in the pantheon of economic ideas. This is my argument in the first part of the paper, and I intend it as a riff on the way that learning is central to how Rizzo understand what it means to be rational.

Much LBD now goes on in teams and in the second part of the paper I consider how teams should be organised for this purpose. The problem I suggest is how to manage diversity within teams that is crucial for successful LBD so that this diversity does not undermine the social capital upon which successful LBD also depends. I focus for this purpose on the rules of the team and take my inspiration from what political theorists have said about a similar problem i.e. how to design the rules of society so that people, who are fundamentally different, engage in positive-sum activities and not zero-sum ones. You need checks and balances so that no individual or faction has the opportunity (i.e. the incentive) to behave in zero-sum ways. This is the fundamental problem addressed by much public policy. My proposals in this vein for teams are egalitarian in a De Tocqueville-like manner. If my specific suggestions sometimes look more like a university department of some years back than the departments of today, then maybe this reflects how university management has failed to learn from the experience of others when emulating how teams more generally are typically managed now. i.e. relative to the standards I propose, these teams are often managed badly.

If I am right about this poor management more generally, then we should not be so surprised to find, as it has, that productivity growth has slowed down in most OECD countries.

I began by distinguishing between two different types of learning: learning how actions connect with outcomes and learning how to value outcomes. Much of the subsequent argument regarding the importance of LBD and its connection to entrepreneurship has focussed on the first of these – particularly in my recent discussion of entrepreneurship in teams. This should not obscure the possible relevance of this argument to the second type of learning: see, for example, the reference to Hirschman on ‘love’ and learning to value civic virtue. Indeed, the whole domain of politics is ripe for the application (on another day) of the LBD in this respect. Politics is a place where people discuss, reflect and decide on what to value. There are political entrepreneurs and there is political LBD.

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