A Peircean Perspective on Koppl's *Expert Failure*

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> Upon this first, and in one sense this sole, rule of reason, that in order to learn, and in so desiring not to be satisfied with what you already incline to think, there follows one corollary which deserves to be inscribed upon every wall of the city of philosophy:
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> Do not block the way of inquiry.
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> C. S. Peirce as quoted by F. A. Hayek (1967, p.134).[1]

Expert Failure by Roger Koppl is an interesting and provocative book. Koppl has focused our attention on what could be a pervasive feature of modern knowledge-rich societies and economies. The extraordinary growth of all types of knowledge and knowing and the individuals who are central to those processes is a hallmark of epistemically creative societies. Typically we call such practitioners experts. We have experts among us when such knowledge and knowing rises to a certain level where it becomes professionalized, canonized in written form and procedure, and compensated often at a premium level. Experts know a lot more about certain things and processes than other people. Experts can be associated both with the learned professions, with the sciences, social sciences, humanities and arts, and also with highly specialized trades and crafts. They may be clustered in networks of like-minded individuals who also form consulting firms and/or in loosely organized professions such as scientific disciplines, medicine, law, and accounting or even trades involved with building, construction, engineering, and the commercial arts. Communities of expertise may even extend to professional sports which now incorporate sophisticated applications of data analytics and mathematical algorithms. We consult with experts privately as special circumstances may require and also publicly as they become part of government agencies and some serve as specialist advisors to elected officials.

A problem with experts in a knowledge rich economy is that they often make mistakes. An expert may erroneously apply some well-accepted conception of his/her specialized procedures to a circumstance or situation where it unexpectedly misperforms. This may often come as a surprise and especially to those experts who are otherwise thought to be honest. There are many examples of what Koppl (p. 5) regards as expert failure in the disciplines, professions, and trades already mentioned and also in religion (p. 192). Motivation is important as well. Experts need to be endogenized within a framework of economic forces which would then acknowledge that they are sensitive to incentives, opportunities, resources, and relative costs like others in society. Of course some experts may have perverse motivations and look to exploit their expertise opportunistically more for personal gain rather than helping those who face problems and dilemmas requiring their services. In general, experts and their clients should have an expectation of mutual gain in these exceptionally asymmetric circumstances where the experts know so much more than the client or the patient. Additionally legal and professional checks may be necessary to balance the asymmetric epistemic disparity between the expert and the client. Experts can be part of or an extension of the problems that they had evolved to help solve. With or without legal rules and professional norms it is possible that expert failure might occur. The extent of expert failure is an important question and it may be just as important for the private sector as for government. If expert failure is a significant problem, then its remedy, call it expert-failure correction, is a preeminent concern. If the processes of expert failure correction are weak, then expert failure may dominate markets, science, professions, universities, and government. Those who might have capacities and abilities to solve many important complex problems in a knowledge rich world might fail more often than they succeed if expert failure is pervasive. A society and economy dominated by expert failure could be a dismal place to live.

Does Koppl raise the issue of expert failure in such a way that it does not become the end story?

One aspect of Koppl's book may be that there is no clear sense of what expert-failure correction processes might look like in general and thus whether they would on net be successful. One of the problems is that Koppl keeps falling back on competitive markets as a paradigm for how self-corrective epistemic processes might work. He especially relies on Hayek's (1936) well-known position on markets as epistemic processes where relative prices and other qualitative dimensions of goods and services in competitive markets facilitate an extraordinary decentralized process of vast overlapping networks of production, consumption, and distribution directing the flow of goods, services, and resources in almost unimaginable detail. Clearly in such processes, mistakes are made and differing degrees and pockets of market failure may occur including recessions and perhaps depressions, but economists understand in large part to what extent markets may be self-corrective and whether those corrective processes may be sluggish or limited. Some economists believe this creates a role for government intervention while others do not. And of course there are those who believe that government failure may be worse than the worst episodes and aspects of market failure.[2] However if expert failure as an array of social processes shared exactly the same characteristics as market failure then expert failure would be another form of market failure. Just like for market failure some might argue that government intervention is needed to remedy expert failure. Since the causes and circumstances of government failure have been investigated as well, some of those lessons might be applicable to expert failure. But Koppl does not make a strong claim that government could know enough to curb expert failure. Government does regulate and license some professions with mixed results as Koppl acknowledges. But this does not answer the general question of whether government could be sufficiently corrective in supervising expert knowing and practice so that pervasive expert failure could be avoided. Licensing and regulating are significant but limited activities for government (p. 205). Even though government may have a public oversight role for some professions, mostly government does not take over the expert professions and make them government agencies. There may be good reasons for such a limited role for government. But it does mean that government may be too weak or ill-structured to have a significant impact on the problem of expert failure in a knowledge rich society.

Parallel to expert failure there is another form of failure that raises similar concerns in an epistemically accentuated economy-- that is science failure. Science has had many spectacular successes in its history which do not need to be recounted here. But there have been many failures and most of them are forgotten once some new discovery is found. Science makes many mistakes and there is a sense in which those scientific mistakes as they are encountered contribute to an innovation or discovery once it has been found, created, replicated, and accepted by the appropriate specialized community of scientists. Again there is an issue of motivation. Scientists need to be considered as human individuals acting in response to relative incentives, costs, and resource constraints as their scientific work unfolds. As with experts more generally considered, scientists may want personal gain in the form of path-breaking fame, position, and reputation more than the real discoveries that benefit other people, society, and science. Problems within science first tend to show up as replication failure. Some supposedly novel discovery is published in a prominent journal gaining the attention of those within and outside of the scientific community. Then others try to reproduce or rely on that research for special applications and extensions. If replication fails, then further problems may be encountered. It may be that the researcher has made an "honest error." Something might have been recorded incorrectly or what was thought to be a small inconsequential anomaly was ignored or discovered but tossed aside for what was thought to be a good reason. Even a small but hard to detect error might make a significant difference. Such errors can be corrected and the results reinterpreted if they are still of scientific importance.

Episodes of replication failure often lead to another outcome besides honest error and this sets off a new layer of problems. Often detailed scrutiny of what was thought to be a path breaking piece of scientific research leads to allegations of scientific misconduct (Wible 1998). There are so many complex decisions that get made in most research that there are opportunities to change things slightly or even intentionally fabricate key aspects of the evidence. Once misconduct is suspected, research institutes, universities, and government agencies now have procedures in place to investigate the professional work of those so accused. Scientific fraud—the fabrication and falsification of data and plagiarism—have become major issues in science over the past few decades (Wible 2016). Misuse of research funds, labs, supporting personnel, time, and the adverse reputation it creates for those organizations which have dishonest scientists in their employ often leads to concern that science

failure may be a significant problem. The number of retractions in scientific journals has risen dramatically first in the latter decades of the 20th century and then again in the first two decades of the 21st century. Science failure has become such a significant problem that all research-grant-funding federal agencies in the U.S. now require principal investigators, post-docs, other researchers, and support staff to have certified training in the responsible conduct of research. Whether such training is adequate and strong enough to retard if not decrease research misconduct as a major form of science failure remains to be seen.[3]

The problems of expert failure and science failure may benefit from both mainstream and mainline economics.[4] According to Koppl (p. 97), the "mainline" approach to economics running from Adam Smith and Scottish common sense philosophy to Austrian economics and especially F. A. Hayek and recent Nobel laureate Vernon Smith has a much broader perspective of competition as a rich, subjective process allowing for even more complex conceptions of firms, households, markets, and product and information creation. Knowledge is not nearly so standardizable and generalizable in the mainline approach since there is what Hayek has called "knowledge of particular places, times and circumstances." Essentially an individual with a great deal of creative intelligence needs to conceive of an array of localized abstractions relevant to a particular situation.[5] In a such a highly specialized and particularized niche, an individual immersed in that situation may respond with a creative solution which would have been nearly impossible to imagine by an outsider possessing only objective, descriptive empirical knowledge known from a distance. The abstract conceptions of the situationalized knower, while they may be difficult for an outsider to understand, are objective in a special sense. Given sufficient time, appropriate exposure to, and activity in the same particularized problem situation, another second or third party inquirer might come to understand why things were theorized, empirically tested, and recommended as they were with the terms and language used to construct the situationalized knowledge for that particular circumstance.

These highly complex and particularized situations also lend themselves to epistemic error. Expert knowledge as it is created and applied in a highly unique circumstance is the context for both the possibility of expert success and failure or some unanticipated combination of both. There are limits on knowledge and knowing in complex circumstances and they may lead either to expert success or failure. One must carry out or actually implement the activity prescribed by the expert specialist in order for the consequences of the outcome to be discovered. If a second expert is consulted, then we have small numbers rivalry as a form of active, almost sports-like competition with one expert or team of specialists "against" another rather than the large-numbers competition of mainstream economics.

Besides mainline economics, another partially complementary approach to markets and innovations is of course mainstream economics.[6] Mainstream economics also offers economic ideas relevant to expert failure. Mainstream economics perhaps more so than mainline economics sharply characterizes situations when markets may work well and alternatively when they may fail. Tangible goods and services with readily observable empirical qualities which are facilely reproduced in the private sector under well-known ideal conditions of competition are defined to be private goods. Under such stringent conditions of competition, markets work well, they would be efficient, and when firm or market failure is encountered—markets would be often self-correctable. Surpluses and shortages are eliminated, new products and firms readily enter the market, and those firms which are inefficient often fail and exit the market process. There would be no need for government or expert intervention.

In contrast to private goods, other non-standard goods and services such as public goods and "information" goods have characteristics which undermine the self-corrective processes of competitive markets as understood from a mainstream perspective. Markets may fail significantly either in producing public goods or fashioning economic and institutional processes for the information goods that also have become known as intellectual property. Because information goods and intellectual property are so different than standardized, tangible goods and services, the self-corrective competitive forces of mainstream market conception may never really come into play as such. Instead, intellectual property law takes us in the opposite economic direction towards monopoly rather than competition.[7] The creation of intellectual property is usually incentivized in society by creating economic structures that are as far from competitive markets as possible. Intellectual property rights in most societies come in the form of temporary monopoly rights such as patent, copyright, and trademark protections. This turn towards monopoly and high degrees of concentration rather than competition can also be seen in other domains. Science is a very specific type of information good which at its highest levels of formulation cannot be brought under patent, copyright, or trademark. Science may be more like

a pure public good like national defense. Science seems to exist more toward the monopolistic or highly concentrated end of economic organization rather than near the theoretical ideal of economic competition. Anytime economic processes move toward high levels of concentration if not monopoly, organizational process and episodic event failure is more likely. If experts are viewed as providing applications of highly specialized expert or even scientific-level knowledge, then expert failure is much more than a trivial possibility in small numbers or even monopolistic situations.

Probably one of the least precise aspects of Koppl's *Expert Failure* is his characterization of processes of competition within ordinary economic processes with a mix of conceptual contributions from mainline and mainstream economics. At one point Koppl (p. 114) even reflects on how confusing the various ideas of competition in his book might be. He mixes examples and metaphors of competitive markets from both mainline and mainstream economics often without noting how different the underlying characteristics of these various processes may be. I do agree that the mainstream conception of competitive markets is much more richly understood if it is amended with the richer conceptions of cognitive creativity that Hayek, Kirzner, Popper and even Peirce might bring to highly intelligent actors on both sides of conventional markets. Beyond markets of relatively uncomplicated tangible goods and services lie markets for complex goods and services which have many qualitative dimensions which require high levels of cognitive ability. In these manifoldly complex circumstances, specialization may give way to even higher levels of specialization and scientific experts may emerge or even reemerge at even more esoteric domains of specialization. Although one could continue describing many variations of economic processes across many differing domains of expert and scientific knowledge creation, an alternative could be to take up Hayek's discussion of circumstances when "competition" is very different from the competitive market analysis of a hybrid version of mainline-mainstream economic competition. This hybrid in part is what Koppl (2006) has also identified as "heterodox mainstream economics."

In an essay titled, "Competition as a Discovery Procedure," Hayek (1978) sketches the outlines of a very different conception of competition.[8] He even mentions that this conception is closer to what happens in games and sports. Figuring out the conditions and circumstances of competition as the mainstream conception of markets does is not sufficient for an epistemically active society and economy. As in sports, the process or "game" must be played to completion just to discover which player or team in fact does win. Prediction of an outcome before the game is played can use all of the best information, experts, specialists, and scientists society has, yet the outcome can be different than what was forecasted. Science and expertise in my view are more like sports in this regard. The ideas of the expert and the scientist must be carried out in their domains, their unique investigations, and their highly tailored clinical applications just to see which knowledge options actually work or are effective. The situations for producing these venues of knowledge creation are very different. Often they involve just one or two competitors or perhaps a few more. The production of knowledge and expertise typically comes in the form of a few or a small number of rivals rather than the large numbers of economic competition. Sometimes it may only take one individual expert or scientist to make a discovery essentially playing a one-person game against nature. At the frontiers of science and expertise, monopoly may be a necessary organizational process of last resort.

Small numbers rivalry is a very different kind of "competition" than the competition of conventional or even a hybrid version of mainstream/mainline economics. Small numbers "competition" has inherent benefits and difficulties. The fewness of small numbers of competitors combined with greatly specialized and perhaps even highly esoteric knowledge creates niches where the practice and discourse of the epistemic specialist likely would be highly shrouded. Those without even an educated lay person's awareness of the nuances of a domain of professional activity may find the mind set and conduct of the scientist and/or an expert unintelligible if not baffling. Those outside of the expert's knowledge niche may need to create and have proxies for trust and competence in the expert. Even these epistemic proxies also may be fallible. Reputations of individual experts and scientists do evolve but they can still be inaccurate. Some professions do develop professional codes of ethics and others may evolve well-established norms of interpretation and practice (Koppl p. 75). Advanced educational credentials and certifications may also help to fill in the picture of how competent an expert or professional scientist may be in his/her domain of specialized inquiry and application. But expert failure, even if kept in check, would seem to be a persistent problem for advanced, epistemically rich societies and economies. Science and expertise take place in contexts of relatively high economic concentration and the small numbers rivalry of competition as a discovery procedure.

The idea of expert failure persistence becomes even more of a concern if the intellectual context for the preceding comments is made explicit. If mainstream economics is dominated by an empiricist theory of human knowledge and understanding, then it leads to a mechanistic and thin understanding of economic and knowledge creating processes. In such a thin epistemic process, informational variables providing a few key dimensions of relative information value and scarcity are taken as providing empirical indicators that optimizing transactors need to have in order to be successful with their epistemically-laden economic activities. An optimizing theoretical perspective typically emphasizes mentally neutral conceptions of widespread patterns of behavior rather than active subjective cognition of individuals within those patterns. What mainstream economic theory lacks is a theory of what economic actors do if they need to create or produce the knowledge they wish to use rather than merely responding to empirical indicators. The question then arises about what happens if obvious and thinly-dimensioned relative price information is not available or inadequate? What if the mainstream economic view does not give enough richness and depth to make sense of ill-structured circumstances? Quite clearly new knowledge and other indicators or knowledge need to be produced. Hayek's special circumstances of time and place and also competition as a discovery process are now relevant. The production of new knowledge regardless of its level of application typically occurs in an evolutionary process and not in some mechanistically thin conception of empirical indicator optimization.[9]

What is different for knowledge creation is the conceptualization of a new idea before it has been implemented. The new idea might come as a surprise or it might be a creative twist of something already known. But its success in some future application needs to be imagined before inquiry tests that notion. Typically such notions are called hypotheses. Here one can turn to the ideas of the pragmatist philosopher, scientist, and occasional economist Charles S. Peirce. In contrast to others, Peirce called this process of conjecturing a new idea—whether it is at the frontiers of science, mathematics, philosophy, the economy, or elsewhere in human activity—an abduction.[10] For a much more complete discussion of abduction see Wible (2018). Abduction is an evolutionary process of cognitive creativity and discovery. The term abduction was coined by Peirce in order to place it next to the similarly named and better known processes of deduction and induction. Deduction happens in mathematics and logic and more broadly in deducing implications from broader theoretical ideas. Induction is usually thought to be a process of generalizing from empirical details.[11]

For Peirce neither deduction nor induction is a source of new abstractions or knowledge about the novel phenomena, relations, and patterns encountered in human experience. Nothing really new can be learned from deduction and induction, thus the process of abduction. All three processes working together—deduction, induction, and abduction—fundamentally portray how humans reason in Peirce's view. An abduction is a guess or a conjecture about something that is different and/or how the future might be different than any implication coming from deduction or induction. Peirce conceived of abduction as the most creative aspect of his three-pronged view of human reason in order to circumvent the philosophical and psychological problems that are often raised about human mental activity. The human mind is notoriously difficult to model and has led to sharply different theories, psychologies, and philosophies of mental activity. In particular Peirce was very unhappy with the psychological theories and philosophies of his well-known friend, William James. James has offered some of the most famous and creative interpretations of human cognitive activity. James subjective cognitive psychology drew the attention of economists such as Frank Knight, Thorstein Veblen, and Wesley Mitchell. James' subjectivism has drawn some comment from Koppl (pp. 169-170) as well. One can imagine that James' masterful descriptions of humans in complex cognitive situations could be used to understand some of the complexities facing experts and scientists both when their work is going well and when it is failing.

Peirce sharply disagreed with James over a few things and one of them concerns accepting ideas when information and evidence is weak. James famously argued that when the evidence is weak regarding some important question, we have the right to believe what we want to believe. James (1896) called this the "will to believe." The will to believe was specifically about whether one can believe that God exists even if the evidence is weak. James argued for the affirmative position. Beyond religious belief one can extend the will to believe more broadly. Certainly Peirce thought that was what James had in mind. The comment at the top of the paper, quoted by Hayek, is Peirce's response to James' "will to believe." It's not just in the religious domain, but in many other areas of life and knowledge creation that evidence may be weak relative to what one would like to know. New knowledge, especially new expert and even scientific knowledge, or any newly formed principle of application formulated to make sense of an uncertain situation, requires a more criti-

cal attitude than a mindset of authoritative certainty. Here Peirce argued for a "will to learn" with its corollary: "Do not block the way of inquiry" as Hayek quoted it in 1967. This is clearly an antidote for expert failure. Be alert to the limits of what one knows and the need to produce new expertise, new science, and new practice when those limits have been encountered. A mechanistic mind set may pervade those who are less critical in their specialized domains of science and practice. Those who believe in mechanistic processes with something like errorless precision—whether in nature, physics, biology, medicine, economics, or the expert professions—simply do not realize how inaccurate the most accurate methods of observation, measurement, and practice may be in those domains of inquiry. Attempting to measure things like the speed of light and gravity in his own day and probably the nation's greatest expert on weights and measures in the late 19th century, Peirce (1892, p. 303) held that the best results of science may be no more accurate than the "upholsterer's measurements of carpets and curtains." Similarly he claimed "the idea of mathematical exactitude being demonstrated in the laboratory will appear simply ridiculous" (Peirce 1892, EP 1, p. 303).

As already noted, a few years later Peirce would formulate his "will to learn" in response to James' "will to believe." That statement of the "will to learn" was followed by a few general sentiments about how robust the nature of science can be in an uncertain world. Quoted together we have these words:

> The first thing that the Will to Learn supposes is a dissatisfaction with one's present state of opinion.... (Peirce 1898, pp. 170-171).
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> The only end of science, as such, is to learn the lesson that the universe has to teach it.... But insofar as it does this, the solid ground of fact fails it. It feels from the moment that its position is only provisional. It must then find confirmations.... they are only partial. It still is not standing upon the bedrock of fact. It is walking upon a bog, and can only say this ground seems to hold for the present. Here I will stay till it begins to give way. Moreover, in all its progress, science vaguely feels that it is only learning a lesson (Peirce 1898, p. 176-177).

Then a few paragraphs later comes the quote at the beginning of this review, the passage quoted by Hayek and others "Do not block the way of inquiry," (Peirce 1898, pp. 178). Thereafter, Peirce mentions several ways he imagines inquiry can be blocked. The road to learning and inquiry could be blocked with an attitude of absolute assertion or by the opposite disposition that nothing can be known. Another barrier to inquiry may be the view that something is so basic that it cannot be explained or understood in a more fundamental way. A fourth barrier to inquiry could be the idea that one has found the last or even a perfect explanation of what is being observed or experienced. Anyone of these ways of blocking inquiry together or separately might account for many patterns of expert and science failure. Surely there are others.

Here it can be argued that experts and scientists need to have the more critical attitude of the "will to learn" rather than the "will to believe." One can understand how a long and complicated graduate level education or professional internship in some intricate niche of professional knowledge and practice might lend itself to hubris, misinterpretation, and a culture of authority as described by Peirce in attitudes that block the way of inquiry. So-called "authorities" may dislike those who might question their expertise. Koppl provides episodes from many domains of research, inquiry, and expertise where experts believe that because they are experts and have become authorities in their fields that consequently they should not be questioned by a rival professional, cross-examined by lawyers, or even criticized by interested lay parties. Just because one has acquired a vast body of knowledge and practice that is quite useful when appropriately and professionally practiced at a high standard does not insulate one from episodes of expert and/or science failure. If nature and human experience are open, evolving, and capable of novelty at many different levels then a unique event can occur for which there is no known solution, practice, or procedure. Such openness argues for the cultivation of an attitude of humility so that the expert and/or scientist can recognize when something fundamentally new is encountered. The next client, patient, social phenomena, or natural event may bring something never observed to this point in history. Past practice applied to novel phenomena is a prescription for failure if the novelty fails to go unrecognized.

If the attitude of the expert allows for the nearly contradictory simultaneous awareness that either success or failure may be imminent in the next circumstances emanating from the patient, experiment, or problem-situation, then one might have a general sense of optimism about experts and expertise in general. Optimism would be warranted if experts reflect the sentiments of Peirce's quote just above.

Paraphrasing for experts we could have this more specialized Peircean statement of how to proceed from the will to learn:

> The only end of expertise, as such, is to learn the lessons that science and practice have to teach ....But insofar as expertise does this, the solid ground of fact may fail. If feels that expert theory or practice from moment to moment is only provisional. It must then find confirmations that are only partial. It is still not standing upon the bedrock of fact. It is like walking upon a bog and one can only say this ground seems to hold for the present. Here I will stay till it gives way to newer results and facts. Moreover, in all its apparent progress, any area of expertise should feel that it is only learning the next lesson that phenomena encountered in this line of inquiry would teach.

Beyond this general Peircean perspective, there are a few issues that could be raised however briefly with this view in mind. One significant concern relates to the widely used phrase, marketplace of ideas. That metaphor is often asserted in order to extend the conception of a self-corrective free market from the realm of commerce, goods, and services to the domain of ideas and scientific research. However, the conception of a marketplace of ideas is mostly carried too far. If one is serious about these epistemic processes from an economic perspective, one needs to realize that the production of new ideas and scientific research share almost none of the economic characteristics of competitive market processes as most economists understand that term. Extending what was argued previously, the "market place of ideas" is permeated with economic organizational and process characteristics usually associated with economic concentration and market failure rather than self-correctiveness. How these processes could ever be successful in the knowledge domain when they raise legitimate concerns about market failure, government failure, science failure, and expert failure is a subject worth investigating. Koppl (pp. 217-220) and some of his co-authors have begun to study this problem and they should be commended for doing so. Koppl and others have done explorations of alternative institutional designs. These may help identify when and how otherwise highly concentrated economic processes such as those in expert professions and scientific investigation might succeed at least in a limited way. Some day the literature on how situations of small-numbers of rivalrous players succeed and are somehow corrective in the face of economic forces of concentration engendering error could be placed along side our understanding of why and how many market situations are self-corrective. These could be entirely new understandings of how the private sector is successful separate from government and markets as conventionally understood.

Another more specific area of expertise deserving some comment and raised by Koppl (190-191) with regard to expert failure is central banking. Probably the most prominent central bank on the world stage today is the U. S. Federal Reserve System. Similarly the European Central Bank, a relatively new creation with the advent of the European Monetary Union, has many of the same institutional features of the Fed and finds itself embedded in a political union of capitalist, market-oriented economies. Also, central banks around the world routinely communicate and act in concert especially when they perceive the need to do so. By definition central banking is a domain of high economic concentration internationally and usually something like near-monopoly domestically. Here as in other domains, there is expert failure. The literature on the Great Depression of the 1930s and the Great Inflation of the late 1960s and 1970s places significant blame on the Fed for making those otherwise recessionary or inflationary economic situations much worse than they needed to be. Similarly for the recent Great Recession of 2007-09, John Taylor has criticized the Fed for lowering short term interest rates too much and for not following his historically and empirically supported "Taylor Rule" of monetary policy.[12] While these critiques of the Fed are powerful, one might suspect that central banks are going to be a prominent feature of the institutional structure of advanced financial economies into the foreseeable future.

Probably a more relevant approach to the flaws and errors of central banking would be to bring lessons of expert failure, science failure, and market failure to central banking in a new way.[13] One of those lessons for central banking would be to let domains of market efficiency alone wherever they may flourish; or if some government role is helpful, to expect aspects of government failure and thus minimize the role of government to the greatest extent possible. Another lesson would be to learn from past mistakes of central banking history and a third might be to cultivate a skeptical attitude regarding the sharp assurances of forecasters especially when confronted with novel innovations and circumstances in the economy and financial markets. It does appear that the Fed as an institution has learned to some degree from its historical mistakes in past economic cri-

ses. At the time of the recent Great Recession around 2007, many of the Fed's top economists seemed to be very much aware of the past mistakes of that institution. As mentioned it had pursued contractionary monetary policy quite unwittingly in the 1930s and did not do enough to dampen inflation in the 1970s. The Fed also seemed to be aware in the early 2000s that macro theory had taken a turn towards general equilibrium theories of the economy that had very little to do with severe short term economic fluctuations. This sets up something of a duality of expertise between the "monetary historians" and the macro general equilibrium "theorists" who aim to create more consistent macro models. Some macro theorists outside the Fed had even expressed the view that the discipline knew enough to forestall any future economic crisis similar to the magnitude of the Great Depression. Actually short term economic forecasting of the sort that central banks might find helpful has almost entirely disappeared from the macroeconomics taught in doctoral programs. Also macro theory as such seems to play a less important role in monetary policy formulation but for a new class of models termed new Keynesian dynamic stochastic general equilibrium (DSGE) macro models. Every central bank now seems to have a DSGE model. The new Keynesian models do incorporate dynamic microfoundations, a conception of the general interrelatedness of all markets, and they embed self-corrective market processes in a new way. The mindless and very mechanistic Keynesian interventionist conception of monetary policy of the late 20th century seems to have receded into the past.

If central banks are prone to expert failure and can never come close to being a central planning agency, one might ask what other lessons or roles could be learned. An alternative perspective could be to view the central bank as being embedded within the knowledge creating economy of mainline/mainstream economics and as such having limited but important roles. As such keeping the payments and financial transaction structure of the economy intact through severe crises could be one of them. If one regards the financial system as a vital payments system essential for the success of the whole economy, then one would want that system to survive intact even through the worst of economic crises. One of the roles of central banks could be to serve as something like a limited public utility regulator with regard to the payments system with responsibility for keeping the transaction grid of the economy and financial markets functioning. For example, if local governments collapse financially as some like New York City, Cleveland, and Orange County have done, society would still need to use roads, streets, and expressways even if those entities fail. Allowing the collapse of the transportation system on top of a government bankruptcy would compound and prolong market failure and economic recovery. Similarly allowing the payments system to collapse as banking and financial institutions collapse would worsen any serious economic and financial crisis. A policy of keeping the payments structure intact provisionally through the worst times of a crisis would seem to be an important step in keeping the crisis from going to a deeper level. This public- utility-like payments system role is important to thinking about what central banks might do successfully.

Another important role for a limited central bank would be to recognize that the Fed has something like a supreme court role for certain aspects of governance and economic policy. Deep structural conflicts in government spending and debt management may emerge within advanced democratic economies. Repeatedly in human history, strong political leaders have demonstrated a willingness to spend more on their priorities while in office and leave it to later governments and generations to deal with sharp increases in sovereign debt. Clearly long-term deficit spending coupled with rising proportions of sovereign debt historically has led to inflation and inflation often has led to political instability. To check the inflationary tendencies of the executive and legislative branches of most modern financially sophisticated nations, many of those countries have structured it so that central banks are independent of other branches of government. While this level of separation has not been achieved officially by formally amending the constitution, it has become something like a constitutional level of institutional innovation. Central bank independence means that legislative and executive branches of government have a check and balance on their worst fiscal excesses and imbalances. Central bank independence needs to be conceived as part of the system of constitutional level checks and balances providing a supreme-court-like veto over government budgets and spending plans that are too extreme and could lead to the collapse of constitutional governance altogether. Thus the central bank needs to serve as a constitutional level check on the economic excesses of the executive and legislative branches of government.

Now it is time to end this review reiterating where it began. In *Expert Failure*_Koppl has favored us all by focusing on important side effects of a complex epistemic society and economy with many avenues of professional and scientific expertise which fail from time to time. In terms of Koppl's own four categories of expert failure, I probably fall in be-

tween some of them. His (p. 28) four categories come from having two types of experts (who succeed or fail) intersect with two categories of lay responders (who behave actively or passively with regard to the experts). His own view tends towards a focus on experts who fail coupled with non-experts who are active and empowered. My view would be to toggle at least initially between Koppl's position and an alternative. Initially I would keep both the prospect of expert success or failure alive and open as possibilities. An attitude of provisional expert optimism needs to be maintained continuously until confronted with an episode or evidence that warrants switching to Koppl's expert failure position. In spite of the myriad possibilities for expert and science failure, those engaged in epistemic processes seem to push them forward more often than they fail in my view. Expert success happens just enough to make these processes worth doing. Expert failure is a significant problem and the only way to keep it in check is to be aware of that problem. A reflexive attitude needs to be kept in mind in the background of thought and practice all of the time. This is the real contribution of Koppl's *Expert Failure*. By having a reflexive but subdued awareness of the possibilities of expert failure running in the back of one's mind and in tandem with an active focus on problems to be solved in order to move forward, success may be found. An awareness of the possibility of expert failure will contribute to the success of those processes. This paradoxical awareness should never go away no matter how much success one has had in whatever field of inquiry, experiment, or therapy. The next episode of science or professional expertise may encounter something truly new. A concern with expert failure may be the only way to keep its worst consequences in check and for expert success to outweigh failure. To answer the question raised previously, consideration of Koppl's *Expert Failure* does not lead necessarily to the pervasively dismal outlook where expert failure is controlling systemically. Overall expert failure seemingly fails to dominate expert success and this would seem to be a good thing. I believe that Koppl would agree with that optimistic assessment.

NOTES

1. Hayek would have had access to this quote in Peirce's *Collected Papers* (Vol. 1, p. 56) which first appeared in the 1930s. The quote was part of Peirce's (1898, p. 178) Cambridge Conference Lectures which have been published in as a complete set of lectures in the late 1990s. Karl Popper also seems to have read Peirce's *Collected Papers*. For a discussion of Peirce and Hayek on abstract ideas and sensation see Wible (2011).
2. For a more extensive discussion about government failure see Dolfsma (2013).
3. This writer has participated in creating an innovative RCR (responsible conduct of research) training program at the University of New Hampshire. UNH may be among the leaders of this type of training. Other universities and colleges across the nation have had to deal with a similar government mandate as part of eligibility requirements for federal research grants. One needs what amounts to a "goldilocks" attitude about such efforts. An RCR program needs neither to be too weak nor too strong. In the context of the extraordinary complexity of the many sciences, social sciences, and private and public research funding sources, RCR programs need more to inform and educate rather than offer some conception of professional and scientific correctness.
5. Koppl (2006) provides a similar distinction between what he calls a heterodox or pluralistic mainstream economics and neoclassical economics. Neoclassical economics would be the textbook orthodoxy found in most leading microeconomic texts of the past few decades. In this book, Koppl seems to use the term "mainline economics" very similarly to what he called heterodox mainstream economics in the 2006 article.
4. The following comments are interpretations based on Hayek (1952, 1967) and Wible (2011).
6. Here I use the term mainstream to refer to the dominant view of late 20th century economics, the neoclassical synthesis of micro and macroeconomics. Here the focus is more on the micro side.
7. Cooter and Ulen (2012, pp. 113-126) explore the monopolistic side of intellectual property rights and information goods.
8. On his conception of competition see also Hayek (1946).
9. McQuade and Butos (2003) provide a rich analysis of how a non-market process evolves corrective features when prices and property rights of science are very different than those of the standard markets, goods, and services of mainstream economics.

10. Peirce stated abduction in the form of a syllogism in parallel to similar statements for deduction and induction. For an abduction we have:

    The surprising fact, *C*, is observed;
    But if *A* were true, *C* would be a matter of course.
    Hence, there is reason to suspect that *A* is true.
    (Peirce 1903, EP 2, p. 231).

11. Such generalization could be simply that certain observations amount to a connected pattern of phenomena that are related in some way not yet fully understood. A more general and universal connection such as causality creates well-known logical problems. A problem of induction occurs if one tries to make a leap from a finite sample or pattern to a universal statement of causation. One might have had a run of good luck and not have encountered the contrary instances which would stand in the way of stating a principle of the highest level of abstraction.
12. Taylor's critique and the response of Fed Chairman Ben Bernanke is summarized in Mishkin (2015, pp. 403-404).
13. Clearly central banks do not see their mission as solving the socialist calculation problem as Hayek formulated that issue in the 1930s.

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