Rationality in Academic Disciplines

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Abstract

Following Fleck and Kuhn, the academia in the twenty first century have come to recognize the value of acknowledging and understanding the diversity of "epistemic cultures", that is, the thought styles of communities engaged in the production of knowledge. For an academic community to construct public knowledge through teamwork, there are two important pre-requisites. First, the members of the community must have a shared language that presupposes approximately the same pairings of concepts and words. Second, they must have a shared epistemic value system on the basis of which they make collective decisions on what is credible and what is not, and choose between competing candidates for excellence in knowledge. A subset of such criteria for critical thinking also allows us to engage in rational argumentation within the community.

If we define "dialogue" as a two-way conversation between two parties, it follows that contemporaneity is a necessary condition for all dialogue: we cannot have any dialogue with ancient cultures or civilizations of the past. If dialogue involves rational argumentation across epistemic cultures, it is equally important that their epistemic value systems have a set of shared commitments as well. In my paper, I will make an attempt to outline such a shared set of commitments that provide the basis for dialogue across academic cultures, ranging from history and philosophy to biology and physics, and various sub-communities within a discipline.

1. Unity in the Diversity of Academic Inquiry

The word *rational* means "agreeable to reason," or "reasonable," and *irrational* means "contrary to reason" or "unreasonable." Rational inquiry would therefore be inquiry that is founded on a commitment to the value

of reason.

Now, what appears reasonable to one person or community may not appear reasonable to another. As a result, what is judged to be highly credible or of high quality by one individual may be judged to be not credible or of poor quality by another. In many instances, disagreements on what is reasonable and what is credible arise from differences in the prior knowledge and value systems that we tend to take for granted.

Any evaluation of quality in any domain involves a set of commitments to a value system on the basis of which we perform the evaluation. When we judge a person to be more beautiful or graceful than another, an action to be morally good or bad, a pumpkin pie to be the most delicious we have had, a person to be a better tennis player than another, or a teacher to be outstanding, we draw upon an implicit or explicit system of *criteria for evaluation*. The pursuit of academic excellence is not different from these activities in that academic judgments also involve a set of commitments to what constitutes good or reliable academic knowledge, on the basis of which we judge academic work to be poor, good, or excellent. Every time academics grade a student essay, evaluate a doctoral thesis, argue with one another on the relative merits of competing theories, or think through a research problem, they draw upon an academic value system.

In a number of domains, the criteria upon which our evaluation is based vary across individuals, causing their judgments to diverge. Thus, the garlic pickle that one person judges to be the tastiest in the world may be judged as foul tasting by another for whom garlic is unpleasant. Likewise, disagreements on the relative beauty or grace of two models may not be resolvable because one person may be attracted by the sultry looks that another person reacts negatively to. The situation is no different in academic work. A research paper judged to be excellent by one journal reviewer may be judged to be unpublishable by another, and a student essay that receives a C from one professor may receive an A+ from another.

In spite of these individual differences, the value systems of the members of a community have a set of shared characteristics, and most individuals in a community imbibe and conform to this socially shared system of values. Hence, we find relative uniformity within a culture, but variability

across cultures. Plump women used to be regarded as beautiful in Western cultures during a certain period, and they still are in some current cultures, but are surely not so in modern western cultures. This is a general pattern that cuts across individuals in a given culture. Likewise, premarital sex is judged to be immoral in some communities but morally neutral in others. A singer unanimously judged to be the best in the community of South Indian classical music may sound harsh to the European ear. Likewise, a theoretical framework that is judged to be a major breakthrough in some academic circles may be judged to be mediocre in others.

Differences in academic value systems constitute one of the central components of the differences that come under the rubric of paradigms or "discourses". That scientific research is predicated on a set of largely implicit axiomatic commitments was probably first pointed out in 1935 by Ludwik Fleck in *Genesis and Development of a Scientific Fact*. Fleck referred to these commitments as thought-styles. His insight was popularized by Kuhn in 1962 in *The Structure of Scientific Revolutions* which raised the problem of incommensurability across scientific communities with different value systems and different terminologies. Kuhn used the term "paradigm" instead of "thought-style" to refer to the commitments that drive scientific research. The notion of paradigms has been subsequently generalized to academic work in general, and has given rise to research on the epistemic cultures of academics. In the post-modern language, the epistemological differences among academic communities have come to be designated as alternative "discourses" of different "epistemic cultures."

Now, despite the obvious differences across cultures, there are also certain broad characteristics that are shared by the value systems of different communities, and properties that are repeatedly found in cultures across space and time. Thus, even though some cultures approve female genital mutilation and others consider it barbarous, all human cultures seem to agree that causing suffering and death to fellow humans intentionally and without a compelling moral justification is morally bad. Likewise, qualities like compassion, love, generosity, courage, self-lessness, and truthfulness are typically regarded as morally desirable across human cultures, while qualities like cruelty, hatred, greed, selfishness, cowardice, conceit, deceit, and dishonesty are regarded as morally undesirable. Similar patterns emerge in the judgments of beauty as well. In spite of

individual and cultural differences in what is regarded as beautiful, there are certain broad tendencies that are shared across individuals and cultures such that given extreme cases, even individuals with widely divergent cultural backgrounds agree on which of two people compared is more beautiful than the other.

The common values shared across cultures in ethics and aesthetics point to the possibility of similar cross-cultural patterns in academic values as well. Now, it is fairly obvious that divergences in academic value systems can lead to extremely frustrating situations in academic interactions, and hinder productive collaborations. In debates on beauty, we can agree to disagree and hold on to our personal judgments, and disagreements between judges in beauty contests can be resolved through some form of voting. Most academics would agree that this solution cannot be extended to the problem of academic quality, where quality is not a matter of popularity. A solution to this problem would be for each of us to articulate as explicitly as possible our commitments in academic inquiry, then to identify those commitments shared across individuals or communities, and resolve our differences through negotiation on the basis of the shared commitments.

One way of exploring the value system shared across academic communities ranging from physics to philosophy would be to assume that academic inquiry is a form of rational inquiry, and look for the general characteristics of rational inquiry in a wide spectrum of academic disciplines. In other words, in order to facilitate conversation and healthy debate across epistemic cultures (research paradigms, alternative discourses), it is crucial that we understand our own commitments and see what we have in common with others.

What follows is an initial attempt to identify these shared commitments to facilitate conversations across academic cultures. We may think of it as a manifesto of rational inquiry, the axioms of which are fairly obvious to any academic. I doubt very much if practicing academics would disagree on the desirability of these postulates in principle, but once explicitly formulated we can see that many research programmes do not actually practice what they might agree to in principle.

2. Foundations of Rational Inquiry

Consistency and coherence

The foundational principle of rationality is the prohibition of logical contradictions, explicitly formulated by Greek philosopher Aristotle. We cannot simultaneously believe that the earth is flat and the earth is not flat, or that Zeno broke the jar and Zeno didn't break the jar. Believing in such contradictory statements would amount to irrationality. The prohibition against logical inconsistency (mutual contradiction) may be explicitly stated as:

A. *Logical Consistency:* The totality of statements that we believe to be true (what we regard as knowledge) must not contain logical contradictions.

The prohibition of logical inconsistency is a first step towards rationality. If we give up (A), we cannot engage in rational argumentation, as it is the foundation of rational inquiry in every discipline, ranging from mathematics and physics to history and literary theory.

Related to logical consistency is the somewhat elusive intuition of coherence that is not easy to articulate explicitly except as the property of cohering, i.e., sticking together in a unified manner. Coherence involves connectedness, both conceptual and logical. Compare, for instance the list under (i) with that in (ii):

(i) Gravity, Force, Acceleration, Velocity, Time, Space
(ii) Gravity, Feminism, AIDS, Calculus, Trillion, Schizophrenia

The list in (i) forms a set of conceptually connected items, while that in (ii) is a random set. To take another example, consider paragraph (iii) with that in (iv):

(iii) All gleeps are dovines. All dovines have six legs. Blimpsey is a glump. All glumps have one leg less than a gleep.
(iv) All gleeps are dovines. All gleeps have six legs. Blimpsey is a glunk. All glunks have one leg less than a dovine.

The statements in (iii) are logically connected. By putting them together, we can deduce the consequence that Blimpsey has five legs. In contrast, the statements in (iv) do not form a coherent set.

We will have more to say about coherence later, but for now we can state an important criterion on rational knowledge as follows:

B. *Coherence*: The totality of statements that we believe to be true must be maximally coherent, i.e., must fit together in the best possible way.

While (A) makes an absolute prohibition of logical inconsistency, (B) calls for the maximization of coherence.

For a set of statements to be coherent, they should be free from logical inconsistency, but mere logical consistency is not sufficient for coherence: a random set of unrelated entities which have nothing to do with one another may still be free from logical inconsistency. Hence, even though coherence is a pre-requisite for consistency, the two requirements are not the same.

Justification

Another fundamental requirement of rational inquiry is that of justification, stated as C:

C. *Justification:* The statements that we believe or claim to be true must be justified on basis of appropriate grounds and/or reasoning.

In mathematics, a theorem is justified by demonstrating that it follows from the axioms of the theory. Thus, theorems are justified on the basis of pure reasoning. In physics, a theory is justified by demonstrating that it provides the best explanation for a range of puzzling observations. In ethical philosophy, a conclusion is justified by demonstrating that it follows from our fundamental ethical commitments. An analysis of a poem is justified by showing that it provides an insightful interpretation of the poem that fits with our response to the poem.

As in the case of (A) and (B), criterion (C) is also part of all modes of academic inquiry. What constitute appropriate grounds may not be identical in all disciplines, but the commitment to justification cuts across all forms of rational inquiry.

3. Statements about the world

Fit with experience

As stated above, knowledge claims in the formal sciences of mathematics and logic are justified by showing that they follow from the axioms of the theory. Whether the axioms are true or not is irrelevant. Depending upon which axioms we assume, we get different results. Likewise, ethical judgments are justified on the basis of the ethical axioms that we are committed to. Why is it morally undesirable to kill kittens? Because we are committed to the moral axiom that it is immoral to cause death or suffering to living creatures, and killing kittens is causing death. This justification is not valid if we do not subscribe to the prohibition against causing death and suffering to living creatures.

This state of affairs does not hold for disciplines like history, anthropology, literary criticism, psychology, geography, biology, and physics, where knowledge claims are justified by showing that they fit with our experience of the world. By "experience" we refer to a wide spectrum of input ranging from sensory experience (length), non-sensory experience (pain), data, text, documents, sources, measurements, witness testimonies, and so on. Such statements include theories, frameworks, models, analyses/interpretations, generalizations/correlations, and singular statements. Some of the statements of substantive knowledge are statements of direct experience (e.g., My brother is taller than my sister; there were tears in my aunt's eyes yesterday; there was a flash of lightning two hours ago, followed by a peal of thunder) while others are conclusions drawn from experience (e.g., Men are taller than women; my aunt was sad yesterday; lightning and thunder are caused by the flow of electricity from rain clouds).

We may state as follows a condition on statements about the world:

D. *Fit with experience:* Statements that we believe to be true of the world must fit with our experience of the world.

Given (D) it follows that our experience of the world forms the grounds for the justification of what we believe to be true about the world. We can therefore formulate a more specific version of the condition on justification in (C) to hold on statements about the world. In this version, (C'), the appropriate grounds and reasoning are our experience of the world:

C'. *Justification:* The statements that we believe or claim to be true about the world must be justified on the basis of our experience of the world, together with reasoning where necessary.

Testimonies

What happens when we are not in a position to have direct experience? For instance, let us suppose an acquaintance has borrowed a large sum of money from me, and has repeatedly failed to return it when promised. If he called me and said that he came to my office and didn't find me there, I would not be inclined to believe him. Suppose, however, that three of my colleagues saw him knocking on my door, and then leaving, and told me so, thereby corroborating his statement. Even though I did not actually see him, it is now perfectly rational to subscribe to the belief that he did come to my office when I was away. Such a belief would be based on testimonies, not on direct experience.

If we are not in a position to have direct experience, the next best option is to accept the testimonies of those who have. We may therefore expand C' as C'':

C''. *Justification:* The statements that we believe or claim to be true about the world must be justified on the basis of our experience of the world, and/or testimonies of others on their experience, together with reasoning where necessary.

The commitment to C'' rules out from rational knowledge beliefs based on dogma (It is true because X says so), conformity (It is true because

everyone else thinks it is true), appeal to mortal authority (It is true because my teacher says so), and appeal to divine authority (It is true because my scriptures say so). Such appeals are excluded from academic inquiry, though not, say, from theology and various systems of classical medicine.

Deductive justification

For several centuries, in the Western tradition ranging from Plato to Descartes, Euclidean geometry was looked upon as a model for all human knowledge. Until the end of the nineteenth century, the postulates of mathematical systems were regarded as *a priori* truths about the world. Since the theorems are "proved" (that is, arrived at from the premises through valid deductive logic), if mathematical axioms are *a priori* truths about the world, it follows that mathematical theorems are also truths about the world. This picture of the relation between mathematics and the world was shattered by the discovery of non-Euclidean geometries based on axioms different from those of Euclid. The result was the recognition of a fundamental difference between formal knowledge of the kind provided by mathematics and logic (if such and such statements are true, then such and such other statements are also true), and the knowledge of the world provided by disciplines as diverse as physics, biology, anthropology, history, philosophy of science, and literary criticism (such and such statements are true of the world).

Theorems in the formal sciences (mathematics and logic) are justified on the basis of pure reasoning, without the need to point to experience. In contrast, observational statements are justified by appealing to a direct match with experience.[1] The justification of theoretical hypotheses in empirical sciences involves the appeal to both experience and reasoning. The centrality of evidence and reasoning articulated in (D) is what distinguishes rational knowledge from other forms of knowledge, such as mysticism, intuition, tradition, and commonsense.

Mathematics requires the most stringent form of justification, namely, proof or deductive justification. Thus, a conjecture in mathematics

[1] As pointed out earlier, statements about the world (e.g., sugar is sweet; everything attracts everything else with a force directly proportional to the product of their masses and indirectly proportional to the square distance between them; mangoes are sweeter than lemons) are justified in terms of our experience of the world.

becomes a theorem when we find a proof. In contrast, theories in natural sciences cannot be proved to be true: they can only be justified through non-deductive forms of reasoning.

Equating justification with deductive justification, philosopher Descartes proposed the program of deducing all knowledge from the self-evident axiom "I think." in such a way that every proposition in the body of knowledge was beyond the *least shadow of doubt*. Subsequently, philosopher Hume pointed out that the Cartesian program was impossible, because generalizations based on observations are justified in terms of inductive, not deductive reasoning, and hence are not deductively justified. Scientific theories are justified in terms of speculative-deductive reasoning, not deductive reasoning, and hence the Cartesian program is impossible for science as well. Finally, extending the Cartesian thought experiment to the famous brain-in-the vat conundrum, Harvard philosopher Hilary Putnam showed that no individual can deductively demonstrate even the single observation that (s)he has a body, since there is no way of ruling out the possibility that (s)he is simply a brain in the vat of an alien scientist feeding various inputs to the brain to create the illusion that it has a body and is interacting with people.[2] In sum, whether in terms of a single observation, a generalization based on a set of observations, or an explanation for a set of generalization, the Cartesian program of deductive justification that demands certainty without the shadow of doubt is impossible. Hence, it is imperative that the concept of justification be interpreted in a broad sense going beyond justification in terms of classical deductive reasoning.

Degrees of objectivity

Neither experience (including sensory experience) nor testimonies of others is guaranteed to be an error-free source of knowledge. We have all seen rainbows in the sky, but we also know that there is no such "thing" as the rainbow, that it is an illusion created by the bending of light rays passing through droplets of water. That we see a star at location X in the sky does not necessarily allow us to conclude that there is a star at location X in the sky: perhaps our sensory experience of the star is the result of light rays from a star that died a few decades ago.

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[2] H. Putnam, "The brain in the vat conundrum," *Reason, Truth, and History*.

Compare the following examples:

Example I:	
Evidence:	I saw a book on the table in front of me.
Conclusion:	There was a book on the table.
Example II:	
Evidence:	I saw a rod half immersed in water in front of me, bent at the point of immersion.
Conclusion:	There was a rod half immersed in water, bent at the point of immersion.

We consider the conclusion in the first example as justified. The conclusion in the second example, however, we treat as a mistake because we have evidence from other sources to believe that the sensory experience reported here is an illusion. In other words, experience, sensory or otherwise, can be misleading in the sense that it can lead us to incorrect observations on the world.

Because we are aware of this pitfall, we look for additional evidence to **corroborate** or **correct** our initial conclusions based on sensory experience. Let us suppose that we see a jar on a stand on the table. We legitimately conclude that there is a solid object (a jar) on a stand on the table on the basis of visual sensory experience. We now feel the jar with our fingers, and the tactile sensory experience corroborates our earlier conclusion that there is a solid object on the stand in front of us. Now, suppose our fingers had passed right through the jar, without meeting with resistance. We would then have concluded the opposite, namely, that there is no solid object on the stand in front of us, and that the earlier conclusion based on visual sensory experience was false. The new conclusion would have been that there is a hologram of a jar in front of us, not a real jar.

Let us take another example. Suppose you walk into a room, and see two suitcases on the floor. You try to lift them, and you find that you can lift suitcase A with some effort, but suitcase B is impossible to lift. You will conclude that suitcase B is much heavier than suitcase A. Given the information that you have, your conclusion, based on the sensation of strain on your muscles when you try to pull something, is quite justifiable. However, suppose you now open the two suitcases, and find that suitcase

A is full of books while suitcase B is empty. You will doubt your earlier conclusion, and wonder why you were unable to lift suitcase B. On futher examination, you notice that suitcase B is screwed to the floor. On the basis of this additional information through the visual channel, you will now conclude that your earlier conclusion was false, and that suitcase A is heavier than suitcase B. The sensation of strain on your muscles need not always be a consequence of the weight of an object, though it is often so.

Let us go back to our earlier example of the visual sensory experience of a jar on a stand, which could be a real jar or a hologram. Suppose we try to pick up what we visually interpreted as the jar. Our fingers touch something solid and heavy, and we pick it up. On the basis of tactile-kinesthetic experience, we will conclude that our internal visual experience of the jar is not an illusion, but is triggered by the "objective" reality of a jar out there in the real world. The sense of objectivity in this case is the result of the eye, the skin, and the muscles pointing to the same conclusion. To put it differently, what the eye says is **corroborated** by what the skin and muscles say.

A characteristic that increases the credibility of a claim about the world is its being justified by evidence from many independent sources:

E. *Independent corroboration:* A conclusion justified by the convergence of evidence from independent sources of evidence (= independently corroborated by different sources of evidence) has greater credibility. The greater the convergence of evidence, the greater the credibility of a statement about the world.

Suppose someone tells us that a close friend of ours has been speaking ill of us to our associates. We will probably dismiss it as a rumour. However, if several people tell us the same thing independently of one another, we will probably change our mind and begin to think that the report may have some truth in it. Corroboration triggers conviction.

If we hear a voice from inside a room, we are justified in believing that there is someone inside the room. If we now open the door and see someone inside the room, the belief based on our auditory experience is

corroborated by our visual experience. If, on the other hand, we do not see anyone inside, we tend to look for recorded speech as the source of the auditory experience. The claim that the accused is guilty of murder, argued on the basis of evidence from an eyewitness (who saw the accused covered in blood on the night of the murder) is made more credible if corroborated by finger prints of the accused on the murder weapon.

Corroboration is a form of coherence, the way different statements fit together. Hence, we may take the requirement of increased corroboration as a special case of the requirement of increased coherence as applied to our knowledge of the world.

We may now define **objectivity** as *independent corroboratability*. Let us suppose that Jen Flagerty wakes up in the morning one day, and recalls the sense of a stranger being near her bed at night. She would probably dismiss it a dream, an extreme case of subjective experience. However, if her sister wakes up and reports the same feeling of a stranger being inside the room at night, Jen would conclude that her initial feeling was not so subjective at all, because it is corroborated by her sister's impression. If she now sees that her window is forced open, and her jewelry is missing, the sense of objectivity would be further heightened. What started out as a purely subjective experience now has become objective reality.

From the purely subjective to totally objective is a continuum. We may say that there is nothing that we can prove to be totally objective. However, the greater the degree of independent corroboratability, the greater the degree of objectivity. Given that increased corroboration is a special case of the requirement of coherence, it follows that objectivity is a special case of coherence.

Yet another special case of independent corroboration is **replicability**, an important consideration in scientific experiments. If John Briggs sees flying horses at midnight every day, chances are that he and others are likely to treat it as an instance of hallucination. However, if several others independently see flying horses at midnight, i.e., if his observation is replicated by others, we are unlikely to attribute it to collective hallucination. Instead, we might think of the possibility that someone has invented a flying machine that looks like a horse. Replicability of experimental results is conventionally required in scientific inquiry:

> "I meditated for four months in the mountains, and at the end of my meditation, it was revealed to me that Einstein's theory of relativity is false. Therefore I am justified in believing that Einstein's theory of relativity is false."
> "Last night, an angel told me in my dreams that Hitler was not responsible for the killing of Jews. Therefore I am justified in believing that Hitler was innocent."

These forms of justification are inadmissible in a form of inquiry that subscribes to (C'').

Many mystical modes explicitly reject (A)-(C'') as not only inadequate but misleading.[3]

4. The Rational Mindset

Uncertainty of knowledge

In the preceding discussion, we had many examples of mistaken conclusions, whether based on experience or testimonies. Now, if there is one characteristic that distinguishes the spirit of twentieth (and twenty first) century science from that of the past, it is an awareness of the fallibility and uncertainty of human knowledge, and the resulting need for systematic questioning. The human mind has a natural desire for total certainty, and a tendency to accept as certain what on closer examination reveals itself to be less than totally certain. It is important therefore to be constantly watchful. Let us state this recognition as follows.

F. *Fallibility and uncertainty:* Human knowledge is fallible and uncertain.

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[3] I am not rejecting the mystical mode of inquiry, or saying that the rational mode is superior to the mystical mode. Nor that it is impossible to provide a rational argument against the mystic's position, or a rational argument to show that the rational mode is superior to the mystical mode: any rational argument presupposes a commitment to the value of rationality which the mystic rejects, so we cannot rationally argue for rationality without the vicious cycle of presupposing what we wish to argue for.

G. *Requirement of questioning:* Hence, statements that we believe or claim to be true must be subjected to systematic questioning.

This awareness lies at the heart of not only history and anthropology, but also physics and biology.

If we wish, we may refer to (F) and (G) as the "postmodern" condition, but it might be useful to remember that it had its origins in early twentieth century science, long before the postmodern discourses discovered the condition. As Richard Feynman puts it:

> "The scientist has a lot of experience with ignorance and doubt and uncertainty, and this experience is of very great importance, I think. When a scientist doesn't know the answer to a problem, he is ignorant. When he has a hunch as to what the result is, he is uncertain. And when he is pretty darn sure of what the result is going to be, he is still in some doubt. We have found it of paramount importance that in order to progress we must recognize our ignorance and leave room for doubt. Scientific knowledge is a body of statements of varying degrees of certainty — some most unsure, some nearly sure, but none *absolutely* certain. Now, we scientists are used to this, and we take it for granted that it is perfectly consistent to be unsure, that it is possible to live and *not* know. But I don't know if everyone realizes this is true. Our freedom to doubt was borne out of a struggle against authority in the early days of science. It was a very deep and long struggle: permit us to question–to doubt—to not be sure. I think that it is important that we do not forget this struggle and thus lose what we have gained. Herein lies a responsibility to society."[4]

Commitment to minimizing uncertainty and error

Having pointed out the importance of uncertainty and the need for questioning, we should also take into consideration what Feynman says about degrees of uncertainty. Though our knowledge is fallible and uncertain, it is not completely unreliable or false either, and not all statements are equal with regard to the degree of certainty. Our third commitment, therefore, is to that of increasing the credibility of what we

[4] Richard Feynman, *"What do you care what other people think?"* p. 245.

take as knowledge:

H. *Systematicity and rigour:* We should do the best we can to increase the reliability of human knowledge by being as systematic and as rigorous as possible, minimizing the possibility of errors, reducing the degree of uncertainty and increasing accuracy.

The commitment to (H) distinguishes natural sciences from some of the postmodernist approaches in the humanities and the social sciences. It drives us to the use of precise measurements in situations where it is meaningful (e.g. measurement of length and weight, but not beauty and happiness), and the use of rigorous mathematical modelling where appropriate and feasible (e.g. in the physical sciences but not when making ethical decisions). We resort to systematic experimental strategies with controlled variables (e.g. in studying the movement of electrons and the effects of brain impairments in rats) but are satisfied with less rigorous means where experimentation is not feasible (e.g. the movement of planets and the effects of brain impairment in humans). The degree of rigour and systematicity in rational inquiry varies across domains, but what is important is the commitment to maximize rigour and systematicity wherever possible and useful.

Collective verification and authentication

Human beings have the natural tendency to conform to the beliefs of their community. Given this tendency, it is not surprising to find that there is considerable overlap between the *private knowledge* of an individual and the *public knowledge* of the community. However, there are three important ways in which the two can be different, namely:

Some of the statements of a given individual's knowledge may be irrelevant for the purposes of public knowledge. (e.g. I happen to know that there was a red car parked near the library at 11 am on 22 February 1999, but this piece of information has no relevance for public knowledge.)

Some of the statements of a given individual's private knowledge may not have entered public knowledge. (e.g. I have discovered something interesting about the Malayalam syntax, but I have not written a paper about it and hence no one else knows about it.)

An individual may disagree with the other members of the community, and hold views that are not in conformity with the community. (e.g. I happen to believe that the currently dominant theory of Optimality Theory is mistaken in using ranking as the formal device for conflict resolution, but I have not managed to convince my research community yet.)

Given the distinction between private knowledge and public knowledge, rational inquiry makes a set of demands on the statements that enter the realm of public knowledge from the realm of private knowledge. Recall that the justification of statements about the world involve appeal to experience. In the formation of public knowledge, we demand that experiential statements be collectively verifiable:

I. *Collective verifiability of experience:* The statements of experience that we appeal to in our justification must be open to independent verification. That is to say, experiential statements must be such that when exposed to the same trigger or situation, different individuals in the community must not disagree on whether the statement is true or false for that trigger or situation.

This commitment rules out beliefs based on hallucinations and dreams (non-replicable sensory perceptions), personal tastes (e.g. garlic tastes foul) and mystical revelations (e.g. I know it is true because an angel revealed it to me yesterday), but allows interpersonally corroborated experience (e.g. we are justified in believing that boiling water falling on our body causes physical pain, and the loss of a loved one causes grief).

A similar condition on independent authentication applies to reasoning as well:

J. *Collective authentication of reasoning:* The reasoning that we appeal to in our justification must be open to independent authentication. That is to say, given a chain of reasoning, different individuals in the community must not disagree on whether it is legitimate or not.

This commitment requires that the members of the community have an explicit or implicit agreement on the rules of inference that connect the premises to the conclusions, and the ground rules on the basis of which we decide whether a statement is true or false. The reasoning in mathematical proofs, for instance, is restricted to deductive reasoning, while the reasoning in empirical generalizations is inductive. The use of these modes of reasoning is agreed upon in the respective communities.

5. Scientific Inquiry

The general principles of rationality stated above are common to all forms of academic inquiry, ranging from philosophy and history to physics and mathematics. In addition to the principles listed above, one may acknowledge (L)-(N) as the central characteristics of theoretical research in the natural sciences, extendable in principle to other domains as well:

K. *Sensory perception:* What our sense organs tell us about the world is credible. Statements about the world must be justified in terms of replicable sensory experience.

L. *Explanation*: Observations must be accompanied by explanations of what we find puzzling in the observations.

M. *Motivation*: Constructs in knowledge propositions must be motivated i.e., shown to be useful for some purpose, where purpose = description, explanation, action, etc.). Theoretical constructs (i.e., classificatory or hypothetical constructs that are postulated in explanations) must be motivated by their usefulness in providing explanations.

The axiom in (K) is a special form of the axiom of the credibility of our experience, which forms one of the two parts of (C'').

In addition, scientific inquiry demands (N) and (O) of its theories:

N. *Correct predictions:* Scientific theories must correctly predict the observations.

O. *Generality and simplicity:* Scientific theories must be as simple and general as possible.

We may think of the requirement of correct predictions (N) as a special case of the requirement of fit with experience (D). Though inquiry in humanities (e.g. history, literary theory) is subject to experience based justification (C'') and fit with experience (D), they are not subject to the specialized conditions in (N)-(O).

6. Conflict resolution

What happens when inferences from axioms (A)-(O) result in conflicts with one another? Take the axiom of the credibility of the sense organs. Under normal circumstances, if we see a vase on a table in front of us, we take it as true that there is a vase on the table, trusting the credibility of what our eyes tell us. However, if we try to pick up the vase and our hands pass through the vase, we conclude that the vase is an optical illusion (a hologram), and there is no vase in front of us. Potentially, the inferences that there is a vase and there is no vase in front of us violate the condition on logical consistency, and hence at least one of the inferences should be ruled out. In this particular case, we assign lower priority to our eyes, and conclude that what our hands tell us is more credible.

Rationality demands that we assign highest priority to the prohibition of logical contradictions, which itself is an axiomatic commitment.

P. *Priority of consistency:* Given a conflict between experience (including (K)) on the one hand, and the prohibition of logical contradictions on the other, the latter has priority.

Given (K), it follows that we would trust what our eyes and hands tell us, and conclude that there both is a vase and isn't a vase in front of us. However, given (P), such a conclusion is illegitimate. Given the conflict between (K) and (P), the winner is (P). Hence we conclude that at least one of the senses is not telling us the truth. Had we assigned higher priority to (K) instead, we would have chosen to believe that there is a

vase in front of us and that there is no vase in front of us, violating the prohibition of inconsistency.

To illustrate further the centrality of (P) in rationality, consider the following axiomatic commitment in certain forms of theological inquiry.

Q. *Credibility of the scriptures:* What the scriptures tell us is credible.

As stated earlier, commitment to (Q) is excluded in academic disciplines, and even forms of metaphysics, but it is found in many forms of theological inquiry. What happens when scriptures contain logical contradictions? Rationality demands that we take logical consistency to have priority over (Q), and reject at least one of the two contradictory propositions in the strictures. Alternatively, we may step outside the bounds of rationality, and, assigning highest priority to (Q), embrace the logical contradiction in the scriptures as truth.[5] If so, (Q) can be replaced by the stronger version in (R):

R. *Infallibility of the scriptures:* What the scriptures tell us is infallible.

Having acknowledged the axiomatic commitment to (Q) as being consistent with rationality (but not in academic disciplines) as long as the prohibition of logical consistency is prior to (Q), we can now see how science and fundamentalist theology diverge in their approach to knowledge. What happens when there is a conflict between (A) to (P) on the one hand, and (Q) on the other? A clear example is the conflict between Evolutionary Theory in biology and the Creationist Theory based on the literal interpretation of the Bible. If we take (R) to have priority over the combination of (A) to (O), the prohibition of logical contradictions demands that we reject the evolutionary theory. If, on the other hand, we take (A) to (P) to have priority over (R), we have to reject the creationist account. Are they both forms of rationality? Yes. Are they both forms of academic rationality? No: academic inquiry demands that we either reject (R) or at least take (A) to (Q) to have priority over (R).

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[5] As pointed out earlier, the position that rationality is limited and that we need to accept logical contradictions to understand reality is found in certain forms of mysticism as well.

Our final example comes from a widely used axiom in everyday life:

S. *Credibility of the knowledgeable*: What credible people tell us is credible.

As in the case of (R), appeal to the credibility of people is inadmissible in academic argumentation, but is commonly used in argumentation in the law court in accepting conclusions and informed opinions of specialists as reliable evidence. Notice that there is a conflict between (S) on the one hand, and the combination of (A) to (Q) on the other. The demands of (A) to (Q) require us to check the evidence and argumentation on our own before accepting a knowledge claim, but when we have no direct access to the relevant evidence, or when the evidence is too specialized for us to process, we relax (A)-(Q) and go by (S) in every day life. However, when the results of (A) to (Q) conflict with those of (S), we go by the former.

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