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The Limitations of Fang Yizhi's Empirical Learning: A Case Study of Evidential Practice in *Wuli Xiaoshi*

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Abstract

Fang Yizhi's empirical learning enlarged the place of natural inquiry within late Ming thought without establishing a sustained program of mathematical and experimental explanation. The difficulty lay in the authority assigned to evidence. His distinction between empirical investigation (*Zhice*) and comprehension of incipient principles (*Tongji*) required attention to particular things, yet their ultimate intelligibility remained grounded in a comprehensive cosmology. Through close readings of selected entries in *Wuli Xiaoshi*, this case study examines how that arrangement worked. The reconciliation of four elements and five phases accommodated rival classifications by changing their standpoint; the concept of fire connected physical activity with moral cultivation; and a paper-hole optical trial supported a criticism of astronomical measurement that the observed result could not independently establish. Annotations by Fang's sons and collaborators nevertheless demonstrate that his inquiry admitted disagreement and correction. His limitations therefore cannot be explained by a simple absence of empirical practice, mathematical resources, or intellectual successors. They concern the uneven development of procedures through which observations could adjudicate between explanations and require the revision of general principles. Fang made the investigation of things integral to learning, but left the correction of its encompassing order dependent largely upon the judgment of the learned interpreter. The argument is confined to the evidential practices visible in this text.

Keywords

Fang Yizhi, Empirical Learning, *Zhice* and *Tongji*, *Wuli Xiaoshi*, Late Ming Thought, History of Science

1. Introduction

Fang Yizhi opens the preface to *Wuli Xiaoshi* by declaring that everything filling Heaven and Earth is a thing. Utensils, affairs, the mind, and even human nature and life belong within this field. Knowledge of principle cannot therefore be complete if it turns away from external objects. Yet the same preface places the sages' comprehension of things within the Changes (Fang, 2019: p. 96). Investigation is indispensable, while the order that makes its findings intelligible is already available. This tension raises the question pursued here: could particular discoveries change the principles through which Fang understood them, or did they chiefly enlarge the range of an established synthesis?

Fang Yizhi (1611-1671) pursued natural knowledge, philology, and Western learning across the Ming-Qing transition. His intellectual range has encouraged assessments that place him close to the threshold of modern science. Peterson's study situates that range within the impetus for intellectual change in seventeenth-century China (Peterson, 1979). Peterson's articles had already traced the Western natural philosophy available in late Ming publications and the movement of Fang's attitude toward Western learning "from interest to indifference" (Peterson, 1973, 1976). Zhang shows that the Jesuit distinction between natural and supernatural causes was itself a contested part of what was transmitted (Zhang, 1999). This scholarship has clarified how Fang selected and reclassified foreign knowledge. Less attention has been paid to how, within his own text, evidence came to bear, or failed to bear, on the choice between competing explanations. That question is the focus here. It extends Peterson's account of Fang's selectivity and qualifies readings that take the breadth of his empirical interests as evidence of proximity to modern science. But the language of anticipation can obscure the relation that most needs explanation. A collection of accurate observations is not yet an account of how observations acquire authority over competing explanations. Nor does the recognition of activity within matter determine how variations in that activity are to be measured. Fang's importance becomes clearer when the growth of empirical knowledge is distinguished from the procedures by which a theory is corrected.

The question of why modern science did not emerge also risks assuming that European developments were the necessary destination of every intellectual tradition. Sivin's criticism of the conventional Scientific Revolution question makes that assumption difficult to sustain (Sivin, 1982). Fang's philosophy cannot explain the subsequent history of Chinese science by itself. It can, however, disclose a specific difficulty in the organization of late Ming inquiry: the accumulation of particulars did not consistently produce a reciprocal relation between observation and general explanation. The present paper is accordingly a case study of Fang's evidential practices in *Wuli Xiaoshi*, and it does not attempt to answer that larger question.

Modern science is understood here as a developing practice in which mathematical descriptions, deliberate trials, and assessable arguments constrain one an-

other. The criterion is not the disappearance of religion or metaphysics. Early modern European investigators retained both. What matters is whether an explanation commits its proponents to results that another investigator can examine, and whether contrary results oblige them to reconsider the explanation.

Empirical learning likewise requires a limited definition. Shixue could refer to practical government, moral sincerity, textual verification, or natural inquiry; it was not the name of a unified scientific school. Here the term denotes Fang's insistence that learning attend to particular things and their grounds. *Zhice* is translated as empirical investigation, without assuming that every instance involved numerical measurement. *Tongji* denotes comprehension of the subtle grounds of transformation. Their relation is not identical to that between experiment and theory. Fang's defense of inquiry, his explanations of natural processes, and the transmission of his learning must be examined before that comparison can be made.

The analysis concentrates on the preface and General Discussion of *Wuli Xiaoshi* and on a small number of entries, mainly from its first two juan: the reconciliation of four elements and five phases, the account of fire, the optical entry on expansive light and contracted shadow, the solar discussion, the correspondence between celestial divisions and terrestrial regions (*fenye*), the spherical Earth, and the annotated entries on wind and rain signs. In each of these entries a general explanatory principle meets a particular observation, report, or trial, so that the relation between evidence and principle can be observed directly. Taken together, they display the main forms this relation assumes in the book: rival classifications are reconciled, a single cause is extended across domains, an arrangement is deliberately varied, and a rule is corrected in annotation. Several also involve Western claims, which allows Fang's reception of imported knowledge to be read alongside his own explanations. The selection is purposive, not representative. It does not survey the medical, botanical, zoological, or technical juan of *Wuli Xiaoshi*, nor Fang's other works such as *Tongya* and *Dongxi jun*, in which the balance between particular findings and comprehensive principles may differ. The conclusions below therefore concern the evidential practices visible in these entries; they describe a recurrent pattern in the text, not the whole of Fang's method.

2. *Zhice* and *Tongji*: The Expansion of Inquiry within a Comprehensive Order

Fang's definition of *Zhice* makes the particularity of things indispensable to knowledge. It asks the investigator to consider differences of kind, disposition, and transformation rather than deduce every result from a general moral principle. In the preface he writes[1]:

Things have their grounds; to investigate them concretely, from the great cycles down to plants and insects, to classify their dispositions, examine their affinities

[1]All English quotations from *Wuli Xiaoshi* in this paper are the author's own translations from the critical edition in *Fang Yizhi quanshu* (Fang, 2019). No published English translation has been used.

and aversions, and infer their constancies and changes—this is called empirical investigation. (Fang, 2019: p. 96)

Fang defines investigation through a sequence of activities. Classification identifies differences among objects; examination concerns their relations and responses; inference seeks patterns across constancy and change. This sequence cannot be reduced to the contemplation of an already complete inner moral awareness. It directs attention toward particulars whose characteristics have to be learned. The reference to plants and insects also matters because it prevents inquiry from being exhausted by the grand scale of cosmology. A philosophy that speaks only of the unity of Heaven and Earth may still fail to explain the behavior of a single small creature. Fang's definition gives such particulars a legitimate claim upon the learner's attention. The General Discussion of *Wuli Xiaoshi* develops this point by criticizing people who profess to understand principle and nature but cannot explain even one thing in detail. It also rejects two opposed habits: the construction of extravagant reports beyond what the senses can establish, and the refusal to believe anything lying outside immediate sensory experience. Neither credulity nor narrow disbelief constitutes adequate investigation. This argument is more demanding than a simple appeal to seeing with one's own eyes. Reports may require consideration even when the investigator has not witnessed their objects; familiar perceptions may require explanation even when their occurrence is beyond doubt. The relevant question is how a claim can be examined, rather than whether its subject is familiar or strange (Fang, 2019: pp. 99-100, 104).

Fang resists an absolute opposition between learning about things and learning about the self. The mind itself is a thing, and the activities of human beings belong within the world they seek to understand.

On this account, external inquiry need not threaten the unity of learning. It can supply the details through which that unity becomes meaningful. Such an argument supports the inclusion of astronomy, medicine, sound, and craft knowledge within learned discussion. It also gives Fang grounds for criticizing forms of moral discourse that regard attention to objects as an intellectual distraction. His challenge to them is direct: an account of principle that abandons things loses the very content it claims to explain.

The enlargement of inquiry nevertheless leaves the authority of its results unsettled. Fang states that *Zhice* contains *Tongji* and criticizes those who discard investigation while claiming to grasp subtle principles directly. Comprehension needs empirical content. It does not follow that every claim belonging to *Tongji* must be revised whenever a particular finding resists it. The preface establishes the first dependence much more clearly than the second.

Tongji seeks the grounds of stillness, responsiveness, and transformation that isolated observations cannot reveal on their own. Fang is right to insist that collecting impressions does not dispense with the need for concepts. The difficulty begins when the concepts can accommodate new findings without specifying what would

count against them. A framework may encompass an ever larger field of experience while remaining unable to decide between different accounts of the same event.

The role of the Changes becomes decisive at this point. In the preface Fang places the sages' comprehension of spirits and classification of things within the Changes, connecting this learning to calendrical, musical, medical, and divinatory knowledge. In the General Discussion he similarly presents the investigation of things and the exhaustive study of subtle transformations as contained in that tradition. These passages do not show that Fang simply refused unfamiliar findings. They show that the framework through which unfamiliar findings acquired a comprehensive meaning was already available. An imported technique or an unexpected observation could enrich the field of particulars without displacing the principles that organized the field as a whole. His criticism of Western learning follows from this conception of completeness. He grants its detailed investigation of things while disputing its comprehension of subtle principles, and adds that its empirical investigation remains incomplete. The judgment recognizes a genuine advantage in particular knowledge without conceding comprehensive intellectual authority. Fang does not have to choose between wholesale acceptance and rejection. He can evaluate foreign findings as contributions to an inquiry whose ultimate scope he understands differently. It would consequently be misleading to explain his position solely through hostility to foreign sources. His concern is with the relationship between particular accomplishments and a complete account of learning.

Nevertheless, the arrangement leaves an asymmetry. Western findings can be criticized for empirical incompleteness, whereas the comprehensive framework can retain authority by claiming to grasp relationships beyond the findings themselves. To establish a stronger reciprocity, Fang would need to specify how a failure in a particular account could require a revision of the principles used in *Tongji*. The passages considered here establish mutual relevance but do not formulate such a general rule. His statement that *Zhice* and *Tongji* do not damage one another protects their coexistence. It does less to explain what happens when a concrete result appears incompatible with a favored synthesis.

The objection that this asks too much of a seventeenth-century thinker has force if the comparison becomes a demand that Fang adopt a later philosophy of science. But Fang's own attack on empty talk makes the authority of evidence a historical question within his project. He requires inquiry into things; the question is what that requirement can compel a learned interpreter to relinquish.

Empirical inquiry thus gained a place in comprehensive learning without securing a fully independent authority over specific natural questions. Such authority need not exclude ethics or metaphysics. It requires only that an account of light, for example, can be assessed by the consequences of its measurements even when those consequences complicate a favored cosmological synthesis.

3. From Natural Unity to Explanatory Discrimination: The Limits of Fang's Method

The entry on four and five elements provides a particularly clear example of how

Fang organizes disagreement. It begins by asking how to decide between the Chinese account of five phases and the Western account of four elements. The difference could have led to a comparison of the explanatory tasks performed by each classification. Fang instead places the alternatives within a range of familiar ways of distinguishing substance, function, matter, and transformation. Four can concern substance and five function; water and fire can be distinguished as two; both can be comprehended within one qi. His argument ends by allowing a series of numerical formulations, provided that their relations are understood through the learning of the Changes (Fang, 2019: pp. 123-124). This response has a significant advantage. Fang refuses to treat a difference of terminology as an immediate contradiction in the structure of nature. Different classifications may divide the same world according to different purposes. Four substances and five functional relations need not compete as identical claims. Such attention to levels of description can prevent a crude opposition between Chinese and Western knowledge. However, resolving an apparent contradiction through a change of standpoint does not establish the truth of either account. It shows that the schemes may coexist; it does not show which scheme explains a particular transformation more accurately.

The distinction matters because classification can become difficult to challenge when every disagreement is redescribed as a difference of aspect. If an observed process fits poorly within one enumeration, another enumeration may be selected without requiring a revision of the underlying unity. This interpretive flexibility strengthens the capacity of the framework to integrate new materials. It weakens its capacity to specify incompatible consequences.

The problem does not lie in the use of numbers as such. Numerical reasoning becomes restrictive when numbers must represent measurable relations, or when their use commits an account to a definite result. In this entry, the movement between numbers principally establishes compatibility among perspectives.

Fang's answer resolves disagreement by locating each classification within a larger unity. It leaves another question open: what observation would show that this reconciliation had failed?

The elemental example clarifies why explanatory discrimination need not begin with rejecting a comprehensive cosmology. A classificatory scheme can be useful without functioning as a causal theory. Four elements and five phases might organize different questions, and their coexistence would not itself be defective. The decisive issue is whether the purpose and limits of each scheme are identified before it is used to interpret a disputed case. If a description is reassigned from substance to function after an awkward observation, the reassignment removes the difficulty without showing that the interpretation has learned anything. A more restrictive comparison would ask what each scheme enables an investigator to distinguish: which changes fall under the proposed categories, which relations recur, and which cases would require a category to be narrowed or abandoned. Such questions do not presume that one tradition must possess a superior list of constituents. They ask whether competing vocabularies carry different explanatory

obligations. Fang's appeal to the Changes supplies a reason why the vocabularies can belong to one order, but it does not specify the cost of choosing one description rather than another. In practical terms, when no possible finding bears against a chosen classification, successful accommodation is difficult to separate from interpretive ingenuity. Fang's own emphasis on inferring constancies and changes offers a basis for a stricter practice: the constancies identified through investigation could limit the classifications used to describe them, rather than merely exemplify an encompassing unity. This possibility marks a tension within his project, not a standard imposed from outside it.

The discussion of fire reveals a related structure in more concrete terms. Fire connects visible combustion with movement, generation, bodily activity, and mental life. The entry draws upon medical writings and family interpretations, moving between differentiated kinds of fire and a general account of the activity of Heaven and the human body. It also relates the regulation of fire to moderation in thought, emotion, and desire. Its closing family statement presents the control of fire through earth, wood, metal, and water as a benefit of sagely activity, before returning to the claim that fire fills the world (Fang, 2019: pp. 127-130). The entry treats these applications as effects of one cause, not as loose analogies. It adopts the statement of the Yuan physician Zhu Zhenheng (1281-1358) that "Heaven is constantly in motion, and human life is likewise constantly in motion; all of this is the doing of fire," and that without this fire Heaven could not generate things nor human beings live. The same quoted account traces the reckless movement of fire to the five natures being stirred by things, and finds its remedy in the sage's settling of them through humaneness, righteousness, centrality, correctness, and stillness. Fang's own comment then generalizes the point: between Heaven and Earth there is nothing that is not fire and nothing that is not water, and when centrality and harmony (*zhonghe*) are attained, the two assist each other. One fire thus moves Heaven, sustains the body, and is regulated by moral cultivation. The entry does not merely explain a physical substance; it places physical activity within an account of life and proper ordering. The breadth of this account is deliberate. Fang's fire is not identical to visible flame, and qi is not adequately translated as matter in the modern physical sense. The vocabulary allows him to consider activity as internal to natural processes rather than requiring a separate account for each domain. It also links useful techniques, bodily care, and moral discipline within a common account of transformation. These are substantial philosophical functions. Their significance is obscured when fire is described either as an anticipation of energy or as a mere superstition.

The difficulty concerns the conditions of application. If fire names combustion in one context, motion in another, and the activity of thought in a third, what establishes that a single cause is operating across all three? Similarities can suggest a hypothesis, but the hypothesis must identify relations that permit more than a retrospective interpretation. It should explain why one process takes place under specified conditions while another does not.

Without this constraint, an inactive object can be understood as containing concealed fire, while an active object displays its operation. Both outcomes remain compatible with the same general account. The explanatory principle becomes difficult to correct precisely because it can describe opposed manifestations.

An immanent cause also leaves quantitative relations undetermined. Explaining why nature is active differs from explaining how a movement changes with distance, resistance, or duration. Fang's account of fire addresses the former more directly than the latter. It gives natural inquiry a direction, but provides few intermediate relations through which measurements could constrain that direction.

The optical entry on "expansive light and contracted shadow" brings the issue closer to experimental practice. Fang questions reports about the sun's size and describes a trial with a pierced sheet of paper. Sunlight passing through a small opening falls upon a stone; raising the paper enlarges the illuminated area. Several openings produce separate spots near the receiving surface, but their images merge as the paper is raised (Fang, 2019: pp. 140-142). The arrangement is deliberately changed and the result observed. Fang did more than collect testimony.

Fang's inference is that light exceeds the limits of its source while shadows diminish, so that straight geometrical lines cannot securely determine the sun's size. There is a legitimate question within this reasoning: the outline of an illuminated image need not simply coincide with the outline of the aperture or luminous source. Instruments and arrangements can modify what appears, and measurement requires an account of that modification. Fang's appeal to an accessible trial gives his objection more substance than a general assertion that Western calculations cannot be trusted. It also shows that imported numerical claims could become objects of criticism rather than passive reception. However, the reported result does not establish the proposed conclusion. Under a simple geometrical account of sunlight passing through an aperture, an illuminated patch can broaden as the distance between aperture and receiving surface increases. The sun has an apparent angular extent; the opening also has a finite size. The contribution of each to the observed patch depends upon the arrangement. Several projected patches may overlap when their dimensions grow relative to the spacing of the openings. These possibilities do not require a rejection of straight-line geometrical reasoning. They require the investigator to distinguish the opening, the projected image, and the luminous source. The geometry of such images has a long history. The question of why light passing through an aperture forms an image resembling the aperture at short distances but the luminous source at greater distances was debated from antiquity and analyzed by Ibn al-Haytham, and it can be resolved in rectilinear terms by treating the image as the superposition of the cones of rays passing from every point of the source through the aperture (Lindberg, 1968). On this analysis, because the sun subtends an angle of about half a degree, the width of the illuminated patch grows with the distance between aperture and receiving surface; the enlargement Fang observed is therefore what straight-line geometry predicts rather than evidence against it.

The dimensions of the apertures, their spacing, and their distances from the receiving surface are not specified. Without those details, the trial cannot decide whether the widening disproves geometrical reasoning. Separate changes in opening size, distance, and spacing would be needed, together with an account of the image expected in each arrangement. Fang records an effect, but does not establish that it could occur only under his preferred explanation.

This does not vindicate every astronomical estimate quoted in the entry. Different speakers question the numerical relations between the sun's diameter, its distance, and its apparent extent. Fang had grounds for doubting the consistency of the reports. The weakness of a reported estimate and the adequacy of an alternative explanation are nevertheless separate issues.

The solar discussion also uses an analogy between the heat of nearby flames and the heat that a large sun should produce on Earth. Ordinary experience makes the analogy intelligible, but the transfer requires assumptions about distance, source size, and the manner in which heating changes across space. An appeal to the familiar heat of a lamp cannot settle those relations on its own. The passage relies upon a recurrent practice: a recognizable effect supplies a persuasive comparison, while the conditions governing its extension remain underdeveloped. Analogical reasoning generates a question and an objection; it does not yet provide the measurements needed to resolve them.

The same difficulty appears in the correspondence between celestial divisions and terrestrial regions. In juan 1, the entry on *fenye* records a criticism, cited from Zhishan, based on the fact that travelers in distant countries encounter celestial appearances comparable to those seen in China. Such a report challenges the exclusive assignment of particular stars to particular Chinese regions. The response is quoted from *Qiancao*, the writings of Fang Yizhi's father, Fang Kongzhao (1591-1655), and refers readers to his *Zhouyi shilun* for details. It permits the correspondences to be applied at different scales: the whole Earth, China, a district, or even a room. The scheme survives because its terms can be reorganized according to the scale under consideration (Fang, 2019: p. 151). The entry combines several voices, so it does not establish a chronological retreat from an earlier rational Fang to a later irrational one. Its significance is methodological. A correspondence challenged by contrary evidence survives through a change in scale. The new flexibility absorbs the objection without identifying conditions under which the revised scheme would fail. Because the scale-changing response belongs to Fang Kongzhao, it cannot by itself be read as a statement of Fang Yizhi's own position. Its bearing on his explanatory commitments lies elsewhere. The heading of the entry, which states that correspondences are arranged in cycles at every scale of Heaven and Earth and that *fenye* is not to be applied rigidly, adopts the father's answer as the conclusion of the entry, and no further objection follows. The reference to *Zhouyi shilun* places the answer within the learning of the Changes that Fang Yizhi inherited and carried forward in *Zhouyi shilun hebian*, his edition of his father's commentary. The answer also has the same form as Fang's own rec-

onciliation of the four elements and five phases, where a disagreement is resolved by changing the level of description. The argument here therefore concerns Fang as compiler and inheritor. He did not author this defense, but he preserved and endorsed a way of saving a correspondence that his own entries also use.

Across these examples, empirical material has more power to enlarge the scope of an explanation than to determine its limits. The shifts of standpoint in the elemental discussion and of scale in the celestial correspondences preserve a common order. The optical case is different: its weakness lies in the inference drawn from a genuine trial. Fang's difficulties consequently cannot be reduced to a single inherited doctrine. They concern the different ways in which evidence could remain insufficiently discriminating even when inquiry was active.

4. Western Learning and the Transmission of Inquiry: Intellectual and Social Conditions

A conceptual limitation is not yet an explanation of historical discontinuity. Methods persist through teaching, collaboration, access to instruments, and the repeated examination of other people's arguments. Fang's explanatory practices must therefore be considered alongside the ways in which his knowledge circulated. *Wuli Xiaoshi* itself provides evidence of both transmission and criticism.

Fang's reception of Western learning was selective. The preface praises the detail of Western investigation while questioning its completeness and its grasp of subtle principles (Fang, 2019: p. 96). A recipient could thus adopt a natural claim without accepting the theological or philosophical authority attached to it. This selectivity was a condition of learning rather than an automatic refusal to learn. Its consequences depended on whether the methods accompanying the accepted claim were also adopted.

In Fang's account of the spherical Earth, for example, the natural claim is linked to earlier Chinese authorities and the idea that learning can survive outside the center after official knowledge has been lost. The passage accepts a significant account of the Earth while giving it a place within the recovery and interpretation of inherited learning (Fang, 2019: pp. 133-134). This conjunction should not be explained as a simple refusal to learn from abroad. The explanation legitimizes foreign information. Yet it also directs attention toward the confirmation of a prior intellectual inheritance, rather than solely toward the procedures through which the information was obtained. Accepting a result and adopting the reasoning that establishes it are distinct achievements. The spherical Earth could be recognized without reconstructing the observations that supported it. A solar estimate could be rejected without a satisfactory procedure for determining the sun's size. Counting the Western propositions Fang accepted would therefore tell us little about the organization of his inquiry. The crucial relation joins a natural question to the instruments, quantities, and inferences through which it can be settled.

There was nevertheless no absolute absence of mathematical resources. The

first six books of Euclid's Elements were translated into Chinese by Matteo Ricci and Xu Guangqi in 1607. Engelfriet's study documents this translation and its reception through 1723 (Engelfriet, 1998). The example limits any explanation that attributes Fang's difficulties to a complete lack of access to deductive mathematics. It also limits claims that Chinese language or inherited thought made formal demonstration intrinsically impossible. A translated structure of definitions, propositions, and proofs was present. Its availability alone does not tell us how far Fang made geometrical proof central to natural explanation. A translated Euclid did not automatically turn optical curiosity into geometrical investigation. One still had to identify the relevant quantities and connect the demonstration to an observed process. In the paper-hole trial, that connection would run from the source and aperture to the dimensions of the projected image. The resource existed; its application remained an intellectual task.

The view that Fang's learning lacked successors is also difficult to reconcile with the book. *Wuli Xiaoshi* contains contributions by his sons and collaborators, and some of their comments place definite restrictions on generalization. In the entry on the range of wind, the account that associates different movements with the four seasons is challenged by the observation that spring winds can flatten grass and autumn winds can carry kites. Discussion then shifts to height, strength, duration, and distance. A comment by Jie Xuan adds a journey from Xuyi to Xinfeng as evidence that an evening's wind need not traverse the enormous distance claimed by a general rule (Fang, 2019: p. 156). In the entry on rain signs, Fang Zhonglü compares weather in different regions and warns that seasonal and local variation prevents a single rule from deciding every case (Fang, 2019: pp. 157-158).

These qualifications belong to named contributors, not all to Fang himself. Their presence nevertheless makes the compilation a record of collaborative criticism. A general claim is tested against a particular season or journey; its scope is narrowed when the comparison fails. The inquiry was neither wholly solitary nor wholly protected from correction.

The limits were uneven. A wind rule could be challenged and a rain sign qualified without requiring a reconsideration of the cosmology that brought those observations together. Local correction was possible; systematic revision of the encompassing account was less determinate. The distinction explains why critical annotations should count as achievements without being treated as proof that the book already contained a complete experimental program.

For this inquiry to become more consistently cumulative, observations would have to retain their conditions when transmitted. An account of wind strength or projected light loses much of its evidential value if readers cannot reconstruct where, when, and under what arrangement the effect occurred. Shared measures and repeatable procedures would also let later investigators distinguish a disagreement about results from a disagreement about interpretation. *Wuli Xiaoshi* preserves observations and objections, but does not consistently organize them around that distinction. The institutional question is consequently more specific

than whether China possessed learned communities: could such communities reproduce the procedures connecting natural claims to decisive evidence?

Dynastic disruption made continuity more difficult. Fang's life crossed the fall of the Ming in 1644, and the editing and publication of his work extended into the Qing. Yet violence cannot explain why an optical result was interpreted in a particular way, just as a textual difficulty cannot explain the loss of a patron or collaborator. Nor can later Qing restrictions be projected backward as direct causes of a conceptual relation already present in the preface. Political circumstances affected the opportunities for inquiry; the structure of explanation affected what those opportunities could produce. Repeated trials required resources as well as curiosity. Instruments had to be obtained or made, and observations demanded time that might otherwise be spent on official, familial, or religious obligations. Such conditions help define the practical demands of sustained investigation. They do not, without more specific evidence, establish that an agrarian economy caused Fang's account of light or that commercial growth would have corrected it. The material history and the intellectual history meet in particular practices, not in a direct equation between an economic system and a philosophy.

Comparison with Europe is most useful at this level of practice. The question is whether a trial distinguishes accounts, whether measurements constrain a model, and whether someone else can follow the reasoning. It is less useful to contrast European rationality with Chinese cultural loyalty. That opposition overlooks inherited commitments on one side and active criticism on the other.

Moral purpose could encourage investigation. Fang's discussion of fire connects bodily care and the restraint of emotion with attention to natural processes. Medicine, weather, and craft knowledge mattered partly because they sustained human life. The source of a question in ethical concerns does not undermine its evidential character. A difficulty arises when the desired coherence of moral and natural order becomes sufficient warrant for a claim that still requires an independent assessment.

Fang's project thus combined an expansive cosmology with a compilation open to particular corrections. This combination could sustain learned inquiry and transmit useful knowledge. It did not consistently supply a procedure for deciding when a new result demanded a new explanatory principle. Strengthening the social continuation of the project alone would not necessarily have resolved that difficulty. Equally, changing its conception of evidence would not by itself have provided instruments, collaborators, or enduring opportunities to use them. The intellectual and social requirements were connected, but neither can stand in for the other.

5. Conclusions

Fang Yizhi made attention to particular things a requirement of comprehensive learning. He challenged scholars who claimed to understand principle while neglecting objects, accepted important contributions from Western learning, and

recorded trials as well as reports. The annotations around his work show that empirical rules could be disputed. These achievements give his thought its historical importance.

They also make its limitations more precise. *Zhice* supplied the particulars that *Tongji* needed, but the dependence did not consistently run in the opposite direction: an adverse result was not always allowed to unsettle the synthesis. Rival elemental classifications could be reconciled by changing their standpoint; celestial correspondences could survive by changing their scale. Fire extended across bodily, physical, and moral activity without relations that would distinguish its applications sharply enough for measurement. The optical trial presented a further problem. Fang altered an arrangement and observed a result, but the result did not discriminate between his objection to astronomical geometry and a geometrical account of the same effect. Empirical commitment was real; its inferential consequences remained uneven.

Neither the availability of foreign knowledge nor the existence of successors resolves this issue. Deductive mathematics had entered Chinese learning, and Fang's family and collaborators continued to examine natural claims. What needed to develop further was the connection among those resources: a way to translate a question into a measurable relation, test competing accounts under specified conditions, and transmit the reasoning so that others could correct it. Fang's example cannot account for the entire history of Chinese science. It identifies a difficulty that a wider institutional history must explain rather than assume away.

The central limitation of Fang's empirical learning in *Wuli Xiaoshi* was therefore a limitation in the authority of evidence. Investigation could enrich, compare, and qualify the knowledge of things more readily than it could reorganize the principles that held that knowledge together. The cosmological unity that legitimized his inquiry also made its ultimate terms harder to revise. In the entries examined here, the enlargement of learning was not matched by established procedures of theoretical correction. Why modern science did not emerge in late Ming China remains a question for institutional, social, and comparative history; Fang's case indicates one condition that such a history would have to consider.

Declaration of Generative Al and Al-Assisted Technologies in Manuscript Preparation

During manuscript preparation, the authors used Claude (Anthropics) solely for limited language editing of selected sentences in order to revise in order to improve clarity. No Al tool was used to generate research content, analyze data, interpret results, or prepare references, the ideas, argument, and intellectual contribution of the paper are entirely original. All AI-assisted suggestions were reviewed, revised where necessary, and approved by the authors, who take full responsibility for the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

Engelfriet, (1998). *Euclid in China: The Genesis of the First Chinese Translation of Euclid's Elements, Books I-VI (Jihe yuanben; Beijing, 1607) and Its Reception Up to 1723*. BRILL. https://doi.org/10.1163/9789004482791

Fang, Y. (2019). *Wuli Xiaoshi* [Small Records of the Principles of Things] (K. Ao, Critical ed.). In D. Huang, & W. Zhu (Eds.), *Fang Yizhi quanshu [Complete Works of Fang Yizhi]* (Vol. 7). Huangshan Publishing House.

Lindberg, D. C. (1968). The Theory of Pinhole Images from Antiquity to the Thirteenth Century. *Archive for History of Exact Sciences, 5,* 154-176. https://doi.org/10.1007/bf00327249

Peterson, W. J. (1973). Western Natural Philosophy Published in Late Ming China. *Proceedings of the American Philosophical Society, 117,* 295-322.

Peterson, W. J. (1976). From Interest to Indifference: Fang I-Chih and Western Learning. *Ch'ing-Shih Wen-t'i, 3,* 72-85.

Peterson, W. J. (1979). *Bitter Gourd: Fang I-Chih and the Impetus for Intellectual Change.* Yale University Press.

Sivin, N. (1982). Why the Scientific Revolution Did Not Take Place in China -or Didn't It? *East Asian Science, Technology, and Medicine, 5,* 45-66. https://doi.org/10.1163/26669323-00501006

Zhang, Q. (1999). About God, Demons, and Miracles: The Jesuit Discourse on the Supernatural in Late Ming China. *Early Science and Medicine, 4,* 1-36. https://doi.org/10.1163/157338299x00012