COLLABORATING FOR COMPREHENSIVITY

CJ FEARNLEY

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Introduction: What is Comprehensivity? How it works? Why it works?

1 Introducing an idea to better understand our worlds and their peoples

Our civilization is so complex that there is a widespread feeling of fragmentation, disorderliness, and incomprehensibility. How can ordinary citizens like you and me redress these major shortcomings in our social worlds?

We think that, despite the apparent difficulties, it is possible for groups of people working collaboratively to significantly improve their understanding of our worlds in all their exquisite complexity.

We think the ongoing stability and thriving of our civilization depends on such a comprehensively informed citizenry.

Buckminster Fuller argued that comprehensivity, an innate-in-children but largely absent-in-schooling proclivity to comprehend the world and each other broadly and deeply, is essential for the general adaptability of humanity. We aim to develop this germ of an idea into a system for improving humanity's comprehensivity.

We call for an ongoing initiative with groups of citizens working together to explore our worlds and its peoples.

We aim to foster a *comprehensivity* that understands enough about enough of the vital aspects of how our worlds work and change to make sense of it all and of each other.

We aim to establish the vital importance of Bucky's guiding epistemic virtue of *comprehensivity*, striving toward “the adequately macro-comprehensive and micro-incisive”.

We aim to foster collaborations where participants engage in dynamic explorations where they whet each other's ideas into sharper more incisive understandings to better learn how it all works.

We aim to build a new tradition of inquiry and action focused on our *comprehensivity*.

We aim to unify our worlds both conceptually and physically.

Since dynamic, creative experimentation is the wisest way to start any new initiative, this site is just a starting point, some guideposts for the beginning. Please carefully consider this draft schema or outline for creating the new tradition of *comprehensive practice* that we aspire to bring forth. After reading about the idea and our nascent effort to implement it, let us know how we can improve it and how you can help us build it. Your ongoing input will be essential for it to succeed!

> [Humanity] is being forced to reestablish, employ, and enjoy [their] innate ``comprehensivity''.[1]
>
> —R. Buckminster Fuller

2 The Vision

Become a *Comprehensivist* ...Become a better, more aware, more informed *citizen*

Learn how the world works ...*Examine* how change is created ... *Learn* how other people think

Explore diverse subjects *broadly* and *deeply* ...*Learn* what the world means and what possibilities it holds

Understand more of the many *traditions of inquiry and action* that drive our civilization and our lives

Organize and Participate in *Explorations* to comprehend how the world works and how it changes

Become a better, more sensitive *listener*

Become a better, more articulate *speaker*

Practice the art of being a *trimtab* (small actions that effect big results)

Together we can gradually become more and more effective *doers* and *thinkers* in addressing the *topics that matter* in our lives and in the world

Engage to more incisively comprehend the whole Universe together!

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1 R. Buckminster Fuller, *Operating manual for spaceship earth*, Chapter 3

3 The Benefits

- To better *understand* each other in a world of silos and tribes
- To better *navigate* our lives in a complex global civilization
- To better form *integrated* multi-perspectival views of our worlds
- To better *team* with others to achieve bigger objectives
- To better imagine, assess, and communicate ideas and actions that may improve the operation and regenerativity of our global civilization
- To become a social trimtab, that is, to better *serve*, *coordinate*, and *guide* associates, colleagues, and fellow-citizens as well as organizations, companies, and governments including our politicians
- To improve our *collective intelligence* to make humanity more robustly adaptable to any and all possible futures
- To provide a forum for the deliberation of the vital issues of our times so we can more effectively inform the governance systems of our civilization
- To help realize, on an ongoing basis, Buckminster Fuller's great ethical aspiration "to make the world work for 100 percent of humanity in the shortest possible time through spontaneous cooperation without ecological damage or disadvantage to anyone"
- To *unify* the world

4 Collaborating Involves Group Explorations

4.1 What is Comprehensivity?

- *Comprehensivity* is our ability to comprehend our worlds broadly and deeply.
- It is a facility in questioning, conceptualizing, interpreting, and acting to build a multi-perspectival yet integrated *understanding* of the world, how it works, and how it changes.

- It is the quality of our lives that shapes all we have learned *in breadth for context* and all we have learned in depth for clarity to form, as Buckminster Fuller put it, “adequately macro-comprehensive and micro-incisive ´ ´ considerations to better engage our worlds and its peoples with understanding and effectiveness.
- It implies developing a large set of subjects about which one can effectively inquire, contextualize, interpret & assess, and creatively re-imagine and re-combine for *meaningful insights* and the forging of *new possibilities*.
- It entails developing a faculty for helping self and others build a broad range of interests and concerns, comprehensive knowledge, and skills, that is, a faculty for comprehensivity awareness and competency.
- It involves recognizing its inherent pathologies including analysis paralysis (an endless accumulation of information), value paralysis (an unrestrained accommodation of everyone's values), and the paralysis of wholism (an unlimited expansion of the whole). So it requires cultivating judgment to stay incisively relevant.

Since it is impossible for any one person to understand all of humanity's accumulated knowing and doing, comprehensive learning may seem unachievable. The idea is that our individual and collective effectiveness in understanding the vital issues of our times will be improved through the dynamics of groups of people effectively exploring many different topics as broadly and deeply as possible over an extended period of time. Guided by the intention to develop an incisively integrated comprehension of our worlds and how they change, participants will inform and gradually hone their judgment both in the areas specifically explored as well as in gradually acquiring general adaptability. Bit by bit, they will become better prepared to ask more incisive questions and imagine more effective actions on subjects for which they have little prior knowledge or awareness. Their insights, new possibilities, and actions will percolate through society enhancing the collective intelligence and adaptability of our civilization as a whole.

Collaborating for comprehensivity welcomes participation from anyone willing to suspend their own certainties to conscientiously explore sensitively, boldly, and collaboratively. Sessions should involve no prerequisite knowledge, beliefs, metaphysical assumptions, or values beyond the communicating systems used to organize and

conduct events. We recommend a crowdsourcing model where participants explore their own topics in their own order curated and explored by the participants themselves. At group events, they exchange experiences, interpretations, beliefs, feelings, values, thoughts, models, apprehensions, understandings, and ways of seeing (perceiving), thinking, and doing. That is, we envision building a new tradition that focuses on listening, sharing, and exploration and which accommodates and includes all backgrounds, beliefs, and cultural traditions.

Does the idea interest you?

What do you like about it? Do you have any concerns?

5 A New Tradition of Inquiry and Action

Collaborating for comprehensivity aspires to develop, democratize, and institutionalize a new tradition of inquiry and action inspired by the great polymaths of history like Aristotle, Archimedes, Zhang Heng, Hypatia, Ibn al-Haytham (Alhazen), Ibn Sina (Avicenna), Shen Kuo, Omar Khayyám, Acharya Hemachandra, Hildegard of Bingen, Albertus Magnus, Nasir al-Din al-Tusi, Leonardo, Cornelius Agrippa, Athanasius Kircher, Christina Queen of Sweden, Ben Franklin, Maria Gaetana Agnesi, Goethe, William Whewell, Buckminster Fuller, John von Neumann, Jacob Bronowski, Mortimer J. Adler, and Dorothy Dunnett. Although anyone can become a comprehensivist by putting into practice studying, thinking, and acting broadly, currently society produces too few comprehensivists, too few who are able to connect humanity's great traditions and its peoples. Our effort aspires to engage anyone who is interested to participate in and/or organize collaborations with a minimum of background, training, and effort.

There are many traditions of inquiry and action that purport to provide initiates with the means to grasp anything (or even everything) including our many spiritual, mystical, and mythological traditions, science and technology, Renaissance humanism, pansophism, the liberal arts, transdisciplinarity, mathesis universalis, universology, consilience, wholism, integral theory, world-systems theory, cultural studies, semiotics, complexity, systemics, cybernetics, and synergetics. While these organizing systems are important cultural resources and should be better understood, none is universally accepted, their assumptions are often controversial, and most involve first learning particular ways of seeing and sophisticated practices of inquiry and

Figure 1: Our Comprehensivity Evokes A Cosmic Perspective

action. Instead, *collaborating for comprehensivity* aims to accommodate the broadest range of people and their traditions in a quest, an exploration, whose direction is clear (toward the broad in scope AND the deeply incisive: toward comprehensivity) but whose destination is unspecified and open-ended.

In “Operating Manual for Spaceship Earth”, Buckminster Fuller wrote, “We have not been seeing our Spaceship Earth as an integrally-designed machine which to be persistently successful must be comprehended and serviced in total”. So comprehensive practice is needed to effectively operate our spaceship effectively. It aspires to a planetary or cosmic perspective in both our conceptuality and in our practice.

6 An idea to unify the world

In “Operating Manual for Spaceship Earth”, Buckminster Fuller (“Bucky”) called for an “uncompromised, metaphysical initiative of unbiased integrity [to] unify the world”.[2] Could attending to our *comprehensivity* help unify the world?

An inspiring model for unification and comprehensivity can be found in the scientific theory of gravity developed by Newton, Einstein, and others. Evidently, every massive particle in the entire physical Universe attracts every other according to an exact mathematical formulation. This expression of universal physical love belies the boundaries and fragmentations of our present-day tribes and silos. It could be that we can similarly develop schemas or models that accommodate every idea and every person in a meticulously comprehensive gestalt despite how daunting it may at first appear?

In speaking about Dante's 700-year-old epic poem “La Commedia”, Giuseppe Mazzotta said, “the presence of viewpoints, various viewpoints, which one somehow manages to control, or know, all viewpoints. ...Perspective means that...the perception of reality changes according to the position we occupy.... Dante uses this perspectivism [which] really means a way of assembling various points of view.” Likewise, our *comprehensivity* assembles and integrates a broadly informed multi-perspectival view of our worlds. Collaborating with many people of different backgrounds, we can facilitate acquiring such a perspectivism. So our initiative engages groups of people to collaborate to gradually realize a broader and deeper and more integrated conception of our worlds.

A collaborative effort to facilitate our comprehensivity inspired by the science of gravity and informed by perspectivism could *unify* the world. Not only would a comprehensively informed conception of the world be more unified than our fragmented ones, but a side effect of identifying and sharing comprehensivist considerations, insights, possibilities, and actions would tend to help everyone better understand each other and better coordinate their actions which would tend to unify the world. These effects might make our civilization more robustly adaptable to any and all possible futures.

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2 R. Buckminster Fuller, *Operating manual for spaceship earth*

Collaborating for comprehensivity is a nascent initiative to engage groups of citizens in diverse explorations to develop comprehensive comprehensions to *unify* our worlds conceptually and physically.

6.1 How it works

Our nascent tradition to cultivate our *comprehensivity* is still inchoate. There are no textbooks. We cannot be sure which of our ideas will work and which may need to be discarded. We welcome your experiments to test our ideas and to try out your ideas so that over time we may learn the best ways to foster our comprehensivity.

We have organized more than 300 events that have served to prototype the idea. Based on that experience, we offer these recommendations and suggestions for how collaborative groups might be structured so that we might build an effective community of practice:

- Groups would ideally meet face-to-face on a recurring basis for a series of conversations (generally exploratory dialogues, but other activities may sometimes be used) to explore a wide variety of topics. Explorations will be broader and richer if participants have diverse backgrounds, knowledge, and skills. So diversifying your group will be well worth the effort.

- Each exploration must ensure the psychological safety of participants so respectful but penetrating probing of strong differences can be effectively engaged and integrated into meaningful outcomes.

- Ideally, all participants will contribute their thoughts and feelings about the subject. Event facilitators ought to start each meeting by inviting each participant to introduce themselves and to comment on the topic to get everyone comfortable with sharing their ideas and to provide stepping stones for exploration.

- Topics ought to be curated so that with a minimum of preparation, participants with no prior awareness of the subject can effectively explore its nuances. Requiring some preparation will produce richer events. Some events should be based on books, videos, or other resources that require more preparation. Please experiment. If too many events involve too much preparation, participants may

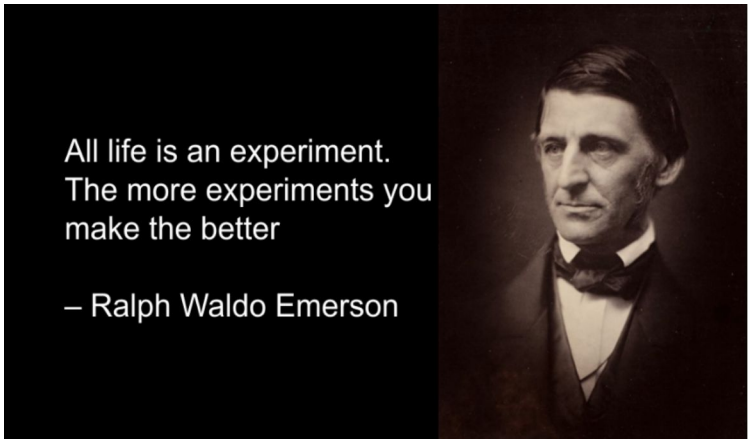


Figure 2: Quote by Ralph Waldo Emerson

not feel prepared and may not contribute to the conversation. Good condensed summaries can make advanced ideas accessible for everyone. Topic curation involves preparing participants to explore a subject deeply even when they have no background.

- Our focus on exploration requires that all participants must suspend their certainties so they can fully engage and examine each other's ideas. Participants are encouraged to share their relevant ideas and even their judgments, but certainty derails exploration. Asking someone who is a bit too certain to explain why they hold their beliefs and then asking the rest of the group to share their beliefs and their justifications for them will often facilitate a transition to a deeper exploration. The group must strive get beyond the shallow batting around of opinions and beliefs that we typically witness on TV. By exploring the range of opinion in the group with a suspension of certainty, everyone can feel heard and most people will naturally transition from partisan “believers” to explorers who listen to and collaboratively build on each others'ideas.
- Each participant ought to organize topics for the group to explore. This is important: only by assessing what is lacking in your own or your group’s comprehensivity will you be able to steer you and your group to more effective considerations. Groups should compassionately mentor any member who struggles in organizing their topics.

- All subjects ought to be “on the table” for exploration. Even seemingly parochial topics can engage our comprehensivity when we recognize that everything is interrelated (witness the physics of gravity!) and we see the challenge of our resistance to a topic as an opportunity to work through our blocks to a more encompassing comprehensivity.

- Groups may benefit from exploring meta-issues such as the importance of listening, voicing, respect, suspension of certainty, and other skills for fostering more effective dialogue and exploration.

- If participants boldly explore the edges of their knowledge and their differences, the meetings will end without a conclusion and with everyone in a state of cognitive dissonance. That is to be expected: it indicates a successful session! The discomfort of cognitive dissonance may be reduced by ending sessions by asking participants about what they learned, what their takeaways from the dialogue were, and whether they glimpsed further into comprehensivist seeing, thinking, or practice. Participants will then be able to build on these insights later.

- Given how complex our worlds are, it can be expected that it will take years to develop a confident comprehensivity. Participants and groups should be patient with their progress yet not shy away from challenging themselves to consider many unfamiliar perspectives. Progress may require confronting and accommodating your biggest intellectual weaknesses, fears, and aversions!

Every group will be different. Every topic will be different. Organizers will try experiments. Some won't work. The basic outline above should provide a rough and ready guide for most groups. If you learn something from your practice, please share it with us so we can all learn more quickly.

Are you ready to collaborate for comprehensivity? Why? Why not?

What do you think of our approach to fostering comprehensivity?

7 Why It Works

Our approach to collaborating for comprehensivity aligns the interests of citizen-stakeholders through a mutual commitment to understanding each other and how our worlds work and change. This motivation is explained in the Buckminster Fuller quote: “One of humanity's prime drives is to understand and be understood”. Furthermore, dynamic, interactive dialogues where each participant is engaged to explore assumptions, to listen sensitively, to speak and be heard, to build ever broader and deeper meanings, and to identify new possibilities in subjects that matter can be thoroughly engaging.

One of our key ideas builds on Buckminster Fuller's idea of a trimtab:

> Something hit me very hard once, thinking about what one little man could do. Think of the Queen Mary—the whole ship goes by and then comes the rudder. And there's a tiny thing at the edge of the rudder called a trimtab. It's a miniature rudder. Just moving the little trim tab builds a low pressure that pulls the rudder around. Takes almost no effort at all. So I said that the little individual can be a trimtab. Society thinks it's going right by you, that it's left you altogether. But if you're doing dynamic things mentally, the fact is that you can just put your foot out like that and the whole big ship of state is going to go. So I said, call me Trimtab.[3]
> —Buckminster Fuller (``Bucky'')

Participants are trimtabs helping each other get leverage on their mutual aim to enhance their comprehensivity. That incentivizes contributions to broaden and deepen each exploration. Over time, participants ought to diagnose their own and their group's strengths, weaknesses, possibilities, and concerns for building a more meticulous, comprehensive, and integrated set of models of our worlds. Such navigational assessments will indicate new directions to explore for honing their sense of the world. These group trimtab effects align participants, group, and purpose.

At the societal level, each session focuses on aspects of our civilization's vital traditions and issues. These subjects are trimtabs to consider new perspectives and their stakeholder concerns. The insights from many such meetings from many allied groups will percolate through society. If such broadly informed comprehensions

3 R. Buckminster Fuller, *Utopia or oblivion: the prospects for humanity*

strengthen our collective intelligence, they would improve our adaptability and improve the governance of our civilization. Such ideas may help identify and align our interdependent interests producing a more robust, regenerative, and thriving society. These combined societal trimtab effects may even help achieve the ambition of Buckminster Fuller "to make the world work for 100 percent of humanity in the shortest possible time through spontaneous cooperation without ecological damage or disadvantage to anyone".

Such an initiative to engage citizen-explorers in *collaborating for comprehensivity* could help *unify* our worlds physically as well as conceptually.

8 Collaborating for Comprehensivity Integrates People, Ideas, and Action

8.1 How To Get Started

Right now, Comprehensivist Wednesdays is the only group experimenting with the idea of *collaborating for comprehensivity* anywhere in the world. Unless its format and time work for you, you will need to organize your own group. Since no one is able to organize groups on their own, group organizers will need to find others to help. They will need to find other participants at least, but aides, assistants, partners, and co-organizers would make the workload lighter and more effective. Who can help you get started?

The first step is to commit to help organize a collaborative group. Then you can work toward a first session. Spend some time considering: How do you want your group to work? Write out your ideas and your story as you'll need them for recruiting participants and for facilitating sessions.

Next, prioritize first things first: choosing a venue, a topic for the first meeting, announcing the first event, how to start the meeting, handling lulls in the conversation, handling conflicting views and personalities, and ending the event. What contingencies can you anticipate and how would you handle them?

Getting people to your event will be challenging. A marketing effort will be required. Since large groups are more difficult to organize, starting with a small group of maybe 10 or 12 (or even 5) people will be easier. Meetup.com can bring one or two new people to your events, but their service is very expensive. Facebook and Eventbrite offer some free event organizing services. If you get creative, you may be able to get going with minimal or negligible expenses.

What is your draft plan to get started? What kind of help do you need to get started?

8.2 Spontaneous Organizing

We would like to see this initiative take off as a social contagion where groups spontaneously form all around the world. We are working to imagine what kind of infrastructure would best support that result. Let us know if you have any ideas.

You are welcome to just jump in, start organizing a group, and share your results with us.

To help folks get started, we have a Resource Center with topical essays that we have used to organize explorations. You can either use them directly or use them as inspiration for forming your own topics and curricula for your initiative.

8.3 Note on the Accessible Design of Our Resources

These ideas and tools are compiled to support initiatives for collaborative development of our comprehensivity, our inclination for comprehensive inquiry and action to better understand and participate in the world.

Our aspiration to be comprehensive means that as we add more and more resources, they tend to iterate more and more deeply into more and more traditions of comprehensive thinking. We aspire to make each of these resources accessible to all participants without prerequisites, without dependencies on other resources. Since the comprehensive approach aspires to integrating and accommodating other subjects some of which are also covered by other resources, there will frequently be overlap and there will sometimes be contradictions among our resources.

To eliminate the need to read prerequisites, each summarizes any ideas that were developed in other resources. Generally, there will be links to related resources so that interested readers can dig deeper. Readers should be able to read each resource on its own for an adequate first-cut exploration. Indeed, such cross-references might best be deferred on a first reading.

In brief, each resource is designed to be accessible on its own.

Some resources highlight a book, essay, video, or other material as the main focus for that resource. In these cases, it is generally recommended that participants read the book, essay, or video first. However, even here we have attempted to summarize the highlighted material so that each resource can be read and understood on its own, but some nuanced allusions to the referenced material may be lost if the highlighted material is not reviewed first.

1 Humanity's Great Traditions of Inquiry and Action

18 July 2020 in Resource Center.

In order to undertake the project of becoming a comprehensivist —to come to understand our worlds more and more broadly and deeply —we need to provision a toolkit for the task. What are all the possible approaches that we might mobilize in our quest to make sense of it all and of each other?

The Design Way[1] by Harold G. Nelson and Erik Stolterman argues that design, not any of the arts or sciences, was humanity's first "tradition of inquiry and action ´ ´. The "Great Books" and "Great Ideas" collections of Mortimer J. Adler and others, inspired us to prefix the word "great" in front of the phrase from *The Design Way.* We now reformulate our initial question as What are the *Great Traditions of Inquiry and Action* that humanity has accumulated through the ages? Will this suffice to delimit the range of possible approaches which a comprehensivist might assay?

First, let's pause to ask: Is it necessary and/or sufficient to encompass all humanity's traditions with the metaphysics of inquiry and action? I am not at all sure, but since we need some organizing principle, as with all proposed and allegedly "obvious" first principles, we might just accept "inquiry and action" as a good enough working hypothesis of the nature of all humanity's traditions without too much thought and boldly adopt it.

1 Harold G. Nelson and Erik Stolterman, [NS12]

1.1 Cataloguing Humanity's Great Traditions of Inquiry and Action

We might attempt to circumscribe the comprehensivist's purview with a survey of university courses. Certainly, in modern civilization, these courses catalogue some of the most important traditions in support of civilization's dynamic functioning. However, the courses that make it into the repositories of free on-line course platforms or into the offerings of any given college or university are limited to those deemed suitable to "academic standards" and market demand. That limits the scope of comprehensiveness that we seek.

The comprehensivist might also assay the vocational training of technicians and artisans, books, journals, magazines, newspapers, articles, essays, reports, documentaries, films, video shorts, museums, libraries, artifacts of industrial and craft traditions, and many other resources. All of these can be passed on from person to person and ideally from generation to generation and so represent a tradition of inquiry and action. They are all excellent resources, but the comprehensivist seeks the broadest possible ken.

How can we encompass the broadest horizon possible? Consider this quote from W. E. H. Stanner's essay "The Dreaming" about the philosophy of Australian Aborigines:

> ``It took well over half a century for Europeans to realize that, behind the outward show, was an inward structure of surprising complexity. It was a century before any real understanding of this structure developed. In one tribe with which I am familiar, a very representative tribe, there are about 100 `invisible' divisions which have to be analysed before one can claim even a serviceable understanding of the tribe's organization. The structure is much more complex than that of an Australian village of the same size. The complexity is in the most striking contrast with the comparative simplicity which rules in the two other departments of aboriginal life—the material culture, on the one hand, and the ideational or metaphysical culture on the other.''[2]

2 W. E. H. Stanner *The dreaming & other essays*

From this report, we may infer that we must not only survey humanity's various traditions of ideational culture (our ideas), and also humanity's rich and varied material cultures including the arts and technology, but also the social structures which, at least in Stanner's assessment of Aborigines, may sometimes be more intricate than we, who live in villages and cities with our extensive divisions of labor, may be conscious of or able to appreciate.

We have now identified three macro-comprehensive categories of traditions of inquiry and action that the comprehensivist should strive to survey and assay: traditions of ideas, material culture, and social structures.

Is the list complete? No, we have omitted the micro unit of human inquiry and action: the experience. Does each packaging of our lives into an experience comprise a tradition of inquiry and action? With the possible exception of the ineffable, experiences are communicable bundles of events and/or happenings, which seems to me sufficient to qualify as a tradition.

The packaging of an experience necessarily involves storytelling. So a *story* is more or less equivalent to the more grounded *experience*.

Would you admit any identified experience or story from any of Earth's billions as a great tradition of inquiry and action which the comprehensivist may use for building their understanding of our worlds and its peoples?

I submit that this list of humanity's traditions of inquiry and action is comprehensive: *ideas*, *material culture*, *social structures*, and *experiences*. What do you think of this categorization? Is this the ken of the comprehensivist?

Whenever we organize a categorization, we should think about Robert Sapolsky's list of the dangers of categorical thinking: 1) we can miss the big picture by focusing on boundaries, 2) we tend to underestimate differences when two cases happen to fall in the same category, 3) we tend to overestimate differences when cases happen to fall on opposite sides of a boundary.

Sapolsky's first concern leads us to wonder: What synergies of the whole might this categorization of humanity's great traditions of inquiry and action obscure from us? Ought the comprehensivist always keep in mind the wholistic integral of all humanity's traditions to keep fluid our perspective for any given particular exploration? I should think so. What do you think?

Sapolsky's second two concerns lead us to ask: Are there items that would challenge the value of our distinctions? Certainly, for example, is music a tradition of material culture (instruments), of social structure (bands and acts), of experience (the music video), and of ideas (music theory)? All our distinctions become blurry when we analyze them too pedantically. Nonetheless, they are essential tools upon which we scope and structure our explorations.

How would you survey the inventory of approaches or traditions that we might mobilize in our quest to comprehensively comprehend our worlds and its peoples?

1.2 Exploring Humanity's Great Traditions

The total inventory of humanity's great traditions of ideas, material culture, social structures, and experiences are too vast for any one person to explore systematically. Little, finite humans need some way to guide our efforts finding resources in this great unmappable repository to build our multi-perspectival yet integrated understandings of the world, how it works, and how it changes. How might we begin, given humanity's abounding and sublime cultural heritage?

Some comprehensivists might limit themselves to assaying those traditions that purport to provide initiates with the means to grasp anything (or even everything). These are the great traditions of universalism. They include our many spiritual, mystical, and mythological traditions, science and technology, Renaissance humanism, the liberal arts, transdisciplinarity, universology, consilience, wholism, integral theory, world-systems theory, cultural studies, semiotics, complexity, systemics, cybernetics, and synergetics.

Should the comprehensivist focus on one or more universalist approaches to understanding the world? A big danger with these traditions is that they may prematurely fix our minds on one way of understanding precluding others. Since none of them is universally accepted, their assumptions can be controversial, and may involve extensive effort to learn, it may be better to dabble in them rather than focus too much on any one of them. Over time, we can iterate more and more into each without losing sight of the full inventory of the great traditions.

The universalist traditions have much to offer. I have spent much of my life exploring synergetics, science and technology, and the liberal arts. And I have made limited forays into wholism, cultural studies, complexity, systemics, cybernetics, semiotics, and integral theory. There should be no shame in focusing on any one of them, but the comprehensivist ought to keep in mind that other resources are available and may sometimes be more incisive than one's favorite tradition.

How should an aspiring comprehensivist decide which tradition of inquiry and action to explore next?

I would recommend five considerations. First, if you have a life mission or objective, then from the full scope offered by the great traditions begin an exploration to see which might best contribute to your current situation.

Second, if you have a current project or interest, explore it thoroughly. Follow your interests and your desires. The book *The Design Way* asserts, "Desire is the destabilizing trigger for transformational change". Comprehensivism is built incrementally: each project or interest that is comprehensively explored provides a stepping stone for an ever-broadening comprehensivism, no matter how parochial it may seem in isolation.

Third, try something that is way outside your comfort zone. As a math/science/philosophy guy, one of the first courses I studied to expand my comprehensivism was Giuseppe Mazzotta's exquisite "ITAL 310: Dante in Translation" from Yale Open Courses. Dante's La Commedia is, as Mazzotta explains, an encyclopedia of learning making it a mini-course in comprehensivism (read my review of the course). Studying epic poetry redressed a deficiency in my intellectual faculties and opened worlds I didn't know existed. Alternatively, if you are poetically or spiritually inclined, maybe it is time for some mathematics or hard-nosed engineering? Exploring what is furthest from your current skills and proclivities is, perhaps, the most effective way to rapidly develop your comprehensivism.

Fourth, if my previous suggestions haven't whetted your appetite, choose one of the universalist traditions. I'd recommend systemics, cultural studies, or synergetics as the most promising, but they all offer some hope of universal applicability. Full disclosure: as Executive Director of the Synergetics Collaborative, my choice of synergetics is clearly biased.

Lastly, if you are not drawn in any particular direction, choose your next comprehensivist exploration at random: there are too many possibilities. There is no right answer. Whatever you explore will bring new magic into your understandings of our worlds and its peoples. Jump in and begin!

Which tradition do you want to explore next? How can our community of collaborating comprehensivists help you get started?

In summary, we have explored the scope of humanity's great traditions of inquiry and action as four categories: ideas, material culture, social structures, and experience. Then we surveyed those traditions that purport to provide practitioners with a particularly incisive perspective. We ended by offering advice to guide comprehensivists in choosing their next exploration. However, you develop your own personal tradition of exploring and integrating humanity's traditions, it is certain that the journey will reorganize your mind with new faculties, new meanings, new possibilities, and new adaptability in navigating our always evolving, dynamic civilization.

This essay was written to provide ideas in support of the 29 July 2020 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

1.3 Addendum

The 1h 37m video from the 29 July 2020 event.

2 The Necessities and Impossibilities of Comprehensivism

04 August 2020 in Resource Center.

If comprehensivism is the process of making sense of it all and of each other, is it even possible? Even if it is impossible, is it necessary that we pursue as many comprehensive comprehensions as we can muster? How can we reconcile the necessities and impossibilities of comprehensivism?

2.1 The Necessities of Comprehensivism

Many excellent motivations and reasons for practicing comprehensivism are given in the Collaborating for Comprehensivism site. The inaugural event in the "Comprehensivist Wednesdays" series explored even more (see the video Why be a Comprehensivist?). Angela Cotellessa's PhD thesis identifies still more.

Here, we will explore three ideas that seem so compelling that we might consider them necessities.

2.2 1. What way or ways of knowing ought a human being practice? What is the proper way of knowing? That is, what approach to learning or epistemology ought we practice?

If we start with the plausible assumption thathumanity's great traditions of inquiry and action encompass all that is humanly knowable, our questions invite us to determine which of the many traditions of inquiry and action might provide the most reliable understandings.

We could speculate; we could guess. We could simply pick the one that we became most enamored with at an impressionable age. Or pick what a teacher, friend or loved one favors. But isn't that a premature jumping to conclusions?

Instead, we should apply a systematic approach: incrementally explore ever more and more of humanity's great traditions of inquiry and action. By ever widening our circle of learning, our assessments will gradually become ever more comprehensive. This is the approach of comprehensivity: the state or quality of pursuing comprehensive comprehensions comprehensively.

Each tradition whets its discriminative edge against the others to sharpen and make more robust our own personal, ever-emerging way of knowing, our personal comprehensivity. By integrating more and more wisdom from each thoroughly considered way of knowing, we structure the context and perspective needed to better assess the value of other ways of knowing. By degrees, we organize an ever more refined integrated synthesis. We build what amounts to our understanding of the world and its peoples.

In sum, comprehensivism is a systematic way of learning from our great traditions; it is a systematic approach to knowing or epistemology. If a systematic approach is most proper, then comprehensivism is the proper epistemology, the proper way of knowing and learning. Hence, comprehensivism is a necessity.

2.3 2. What way or ways of acting in the world ought a human being practice? What is the proper way of acting in the world?

To act effectively in the world requires that we understand how the world works well enough that we have some hope that our actions will have our intended effects. That is, proficient acting in the world depends upon our knowing, our learning, our epistemology. Which we just determined is most properly pursued by comprehensivism. So, if effective acting in the world is the most proper, comprehensivism is again a necessity.

2.4 3. Let's consider this quote from R. Buckminster Fuller's book Operating Manual for Spaceship Earth:

> ``We have not been seeing our Spaceship Earth as an integrally designed machine which to be persistently successful must be comprehended and serviced in total''.

Must our world system be "comprehended and serviced in total" in order to successfully provision and steward our global ecosystems, our value systems, our material and energy resources, and our social systems in support of a thriving population of nearly 8 billion crewmates aboard our spaceship and to do so on a regenerative basis for millennia to come?

If humanity does not comprehensively comprehend these world systems adequately to anticipate their possible disruptions and ensure proactive and effective management of the whole world system on an ongoing basis, who will? God? The divine stoic principle of right action in the moment? Luck?

What guarantor for the destiny of Spaceship Earth would you propose?

It could be that comprehensivism collaboratively pursued is the only approach that is systematic enough and thorough enough to offer some hope that we may understand the world well enough to provision a makeshift patchwork that passably supports the ongoing regenerative functioning of the entire world system.

In sum, comprehensivism seems to be a necessity for managing on an ongoing and a regenerative basis the total world system.

2.5 The Impossibilities of Comprehensivism

Each of the necessities of comprehensivity indicated above aspires to an ever more comprehensive survey of the full inventory of humanity's great traditions of inquiry and action. However, it is numerically impossible for any one finite human to thoroughly explore each tradition. Indeed, it is not even possible to list out all traditions available. Hence, each comprehensivist must humbly submit to understanding but a small subset of humanity's complete cultural heritage.

This is a trivial impossibility for comprehensivism. We should turn our attention to the much more challenging and dangerous pathologies of comprehensivity identified by Harold G. Nelson and Erik Stolterman in their book *The Design Way*.

1. **Analysis Paralysis.** When our need and desire for understanding it all results in endlessly gathering more and more information without a means for convergence on an effective way to navigate and manage our initiatives and projects, analysis paralysis is apt to frustrate our objectives. Analyzing all available information seemed to be a requirement for comprehensivism, but it is an impossibility.

2. **Value Paralysis.** When our need and desire for integrating everyone's value systems into our comprehensive inquiries and actions without an effective way of transcending their mutual ambiguities and contradictions, value paralysis is apt to frustrate our objectives. Accommodating all value systems in our comprehensive comprehensions seemed to be a requirement for comprehensivism, but it is an impossibility.

3. **The Paralysis of Wholism.** When our need and desire for integrating the full context of every system we are considering into a Big Picture without an effective means to limit or contain our survey, the paralysis of wholism is apt to frustrate our objectives. Fully assembling our understandings of the world into a whole seemed to be a requirement for comprehensivism, but it is an impossibility.

In considering these impossibilities, we realize that comprehensivism can never be fully achieved; it is an impossibility. Buckminster Fuller also realized this when he wrote in Synergetics "there can be no finality of human comprehension". So comprehensivism is a guiding ideal; it is an aspiration, not a destination.

2.6 Implications for the Practice of Comprehensivity

Buckminster Fuller characterized the plight of comprehensivity with these words, "The more we know, the more mysterious it becomes that we can and do know both aught and naught." "Aught" means anything and "naught" means nothing. Bucky is saying that we can and do know both anything and nothing.

This paradox that lies at the heart of everyone's practice of comprehensivism is the creative source of its genius. We can come to know anything! Simultaneously, our profound and inescapable ignorance will forever remain palpable reminding us to stay sober and humble in our assessments.

The necessities of comprehensivity beseech us to practice the art more assiduously. While its impossibilities remind us of the importance of cultivating a humble but incisive judgment, so we can boldly navigate the complexities of our objectives more effectively.

It could be that judgment is the key to an effective practice of comprehensivity.

We need to judge when to diverge and widen our circle of learning and when to converge by honing in on a defined subject until we thoroughly comprehend it. We need to judge when we need to gather more information and when we need to integrate what we have. We need to judge which value systems we can integrate into this project and which to leave aside for the moment. We need to judge if our Big Picture is a good enough whole or if more context is required.

In conclusion, Life is episodic and project-oriented. Our judgment chooses how we furnish each episode, when to put it aside, when to complete it, and when to start the next. Judgment may be all you have to guide you on your path. If you aspire to the necessities of comprehensivism while heeding its impossibilities, your judgment will guide you to your proper way of knowing and doing, to your tradition of comprehensivism. May you judge well and learn enough from each of your inevitable mistakes.

This essay was written to provide ideas in support of the 12 August 2020 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

2.7 Addendum

The 1h 41m video from the 12 August 2020 event:

3 The Fundamental Role of Story in Our Lives

08 September 2020 in Resource Center

Comprehensivism is the practice of considering with ever-increasing depth and breadth more and more of Humanity's great traditions of inquiry and action to better comprehend how our worlds work and how they change, so we might all live more effective lives. In this practice, as each explorer reflects on the value of their independent and group learning, they will from time-to-time identify ideas that they think should be collaboratively examined.

Collaborating for Comprehensivism aspires to engage every participant in organizing ideas for the group to explore. We think this kind of engagement of participants is necessary to activate the full potential of the collective intelligence of the group.

To exemplify this aspiration, we will share and explore an idea that we think should be collaboratively examined. Let's investigate the idea that story may play a fundamental role in all traditions of inquiry and action, in the practices of a comprehensivist, and in our lives.

3.1 Is Story Fundamental in Our Lives?

Oral and visual storytelling is known in prehistory. Children love picture books that engage written and visual language. Movies and theater continue to be valued even during global pandemics. We are all moved by good stories. Story is clearly important to our lives, but is it fundamental?

Jacques Hadamard collected evidence that Einstein and others think non-verbally. Mind and thought may extend beyond the reach of story into the realm of the ineffable, beyond what can be described. How might we circumscribe the part of our lives that is about story?

Let's consider the distinction between *what happened* and what we *say* about what happened. The word "fiction" means a construct or invention. What we say about what happened is necessarily an invention of language constructed to report to self or others a story about what happened. That is to say, all description is constructed and invented: it is a fiction.

Story is what is said about what happened, what is happening, or what may happen. All stories are necessarily fictitious even when they adhere closely to the Truth of what happened. In fact, non-fiction is, in a way, more hypocrisy and deception than fiction because it falsely pretends that there is a way of storytelling which somehow provides a privileged access to Truth.

No story, not the most careful scientific report, nor the finest mathematical or logical proof can ever tell us exactly what is, nor exactly what happened. Why? Because, at its best, such reports are symbolic constructs attempting to represent and intimate what is. No description can ever report exactly what happened: that was already lost to the mists of history and the foibles of perception even if your scientific notebook is meticulous!

Arnold Weinstein uses the evocative phrase "fiction of relationship [Wei81]" to describe both the literature that discusses human relationships (family, friendship, business, romance, and more) and, as Weinstein puts it, "the notion that relationship itself may be a fiction". We might glean that our stories, (our "fictions"), about relationship are our principal tools for understanding.

It could be that the basic association in a relationship is the fundamental unit of knowing or understanding. Then an algebraic form to characterize a dawning understanding, an apprehension, might be the relationship aRb, meaning a is associated with b through the relation R. Since the relation R is a construct, Weinstein's view that relationship may be fiction seems apropos. Systems of such relationships would form a story. Knowledge seems to be intimately connected to story in this way.

In more human terms, a person is essentially defined by their relationships to place, people, history, values, passions, inquiries, and initiatives. In these terms, Weinstein calls *fiction of relationship* the "voyage to the other". In this way, his expression addresses the poignancy of the basic issues of our lives.

In sum, we have a phrase that gets at fundamental aspects of our lives and our basic knowing in the world. The stories we tell are a *fiction of relationship*. Our lives themselves are a *fiction of relationship*. Our best languaged way of getting a vague grasp of the wisp of reality is a *fiction of relationship*.

Let's take another tack at seeing story's allegedly fundamental role. If the great traditions of inquiry and action encompass all human knowledge, how does story fit in each tradition?

It is possible to live isolated in the woods and to have great thoughts and build great artifacts, but unless an archeologist discovers your work and manages to piece together enough clues to interpret it astutely, no one will know about it and it cannot contribute to the accumulated wisdom of humanity. Traditions are passed on from person to person. They must be communicated. A tradition necessarily entails communication.

Any way of parsing and communicating experience forms the basis for a tradition. Aggregates of communicated experiences can be organized to form an approach, a way of thinking, a subject, even one's life's work. A teacher or their adherents may organize these stories to formally establish a tradition. Of course, any given collection of communicated experiences may dissipate on the scrapheap of yesterday's babble that didn't coalesce into something transmitted from person to person.

When our communicated experiences arrange themselves into something that gets passed on, they form the storyline of a tradition. In a very important sense, these stories form the great mythology for each tradition's cosmogony and cosmology. In this way, story seems fundamental to all traditions of inquiry and action.

In Joshua Landy's interpretation of Friedrich Nietzsche's "The Gay Science", he argues that each of us should "turn our life into a work of art". Landy adds, "art makes our life beautiful if we tell it as a story". I hear Landy suggesting that our life should be constructed as an artwork and shared as a self-affirming story. In our language, each life would be presented as a tradition which others may then build upon.

When we tell the story of one of the great traditions of inquiry and action (which might be a story of our own life presented as an artwork) or when we compose a story weaving threads among several traditions, we regenerate Humanity's cultural heritage, bringing some of that wisdom forward. It could be that story is the warp and woof of the great traditions of inquiry and action, the fundamental structure upon which we build the knowledge of a comprehensivist.

Is story fundamental to our basic understandings? Is story fundamental in our great traditions of inquiry and action and in our comprehensivity, our state or quality of learning that is broad and deep? Is story fundamental in our lives? If so, how so? If not, why not?

3.2 What is the Role of Story in Our Lives?

In Dame Marina Warner's subtle but profound presentation on "The Truth in Stories", she shows how the fabulist (storytelling) imagination is a form of inquiry. Fantasy, fairy tale, and mythology present, in fact, questions about how things might be, questions about alternative ways of being. Warner says, "The inquiry a story mounts may also take a speculative form: offer a hypothesis, or a set of interlocking and often contradictory hypotheses. This is the enterprise of fantasy." In Marina Warner's able mind, the Truth of the fabulist imagination stands next to the methodologies of science as a way of exploring hypotheses!

This might lead us to an important corollary: assertions are a disguised form of question and ought to evoke a state of wondering: Could it be? How might it be? In what situations might it work out that way?

I think Warner's subtle but penetrating point is that stories always and only present "The Truth" of wondering and inquiry. These Truths of the fabulist imagination may sometimes be more penetrating than what can be disclosed by traditions taking a "neutral" stance including government reporting, journalism, biography, history, and even science.

For our inquiry into the role of story, Marina Warner's insights suggest to me that the great traditions of inquiry and action and their stories are not imperial impositions for us to adopt like vassals, but instead they are questions that should fill us with wonder: What Truths live here? Which of these wonders might apply in our worlds? How can we make sense of this?

For our comprehensivity, the stories from many traditions of inquiry and action can aid our wondering about the possible ways to organize a human mind and a human life. This archive of wonder and wisdom in the great traditions gives us the tools needed to broaden our understanding of it all. This realization reinforces the insight that comprehensivists ought not dismiss any tradition without wondering about the worlds it might open for our consideration.

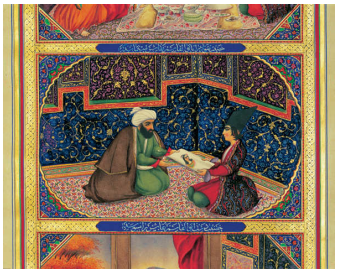


Figure 3.1: Scheherazade and the sultan by Sani ol-Molk (1814-1866), Public Domain

(see Marina Warner's essay "The Truth in Stories")

To dig deeper, we might look at story through the lens of some theories (which are simply traditions held in high esteem by our culture). Consider Claude Shannon's 1948 contribution of information theory. It provides a powerful model for communication at a fundamental level. Is a bitstream a story? Yes: at minimum it is the story of getting this message from here to there. But neither Shannon nor his successors in the tradition of information theory have mathematized interpretation. Interpretation is essential to story: both for the teller and the listener. So, we will need a more powerful theory to operationalize story in our lives.

In the theory of symbolic interaction of George Herbert Meade, our minds, our selves, and our behavior are seen as formed by our interpretations of symbols informed by our accumulation of social interactions. Indeed, our thinking and actions are seen as simply the product of our lifetime of evaluated symbolic interactions. Perhaps, we already knew that mind, self, and behavior were all inextricably linked to experience, but symbolic interactionism sees experience as our individually interpreted symbolic interactions situated within our social milieu, our social environment.

For example, in Harvey Molotch's insightful introduction to the theory of symbolic interaction, the appearance of my neighbor at her doorstep (a symbolic gesture: "I am here") triggers me to turn my just attempted swat at her friendly, but bothersome dog into a wave, into a greeting. The story shows how our actions are the result of our dynamic interpretation of signs in our social worlds and how we think others will receive our actions.

Signs and symbols stand for other things. Signs include anything we might encounter in our interactions with others including words, phrases, gestures, images, icons, artifacts of material culture, social structures, ideas, and any bundling of experience (whether lived, imagined, or communicated). Symbolic interactionism is the idea that our thinking and acting is a product of our interpretations of these signs and symbols from our social milieu motivated by wanting to form a positive sense of self in the eyes of others, that is, motivated by our sense of dignity.

By emphasizing the interpretative role of the accumulation of our lifetime's symbolic interactions, the theory gestures to the gulf that separates what happened from our thinking about it. Moreover, each of our interpretations can be seen as a fiction of relationship: we see the fictive role of interpreting symbolic interactions and its role in understanding the world of relationships in which we live.

At a societal level, symbolic interactionism indicates the value of the great traditions of inquiry and action. These traditions are the source of the symbolic meanings intimated in our interactions. Our interpreted interactions regenerate society by rearticulating and reevaluating the traditions that inform each symbolic interaction. As this process permeates each interaction of each person throughout society, the dynamic manifestation in our minds and in our behavior of our reinterpreted and hence reformulated traditions continually regenerates society.

By showing how these interpreted symbolic interactions so directly affect our minds, behavior, and society, the theory makes clear the value of learning from and curating the wisdom in humanity's vast inventory of traditions of inquiry and action. It provides new insights into how our learning affects us and how that in turn changes the world.

To emphasize this point, it is the stories we tell ourselves and others about the great traditions that informs, and in fact forms, our minds, shapes our behavior, and molds our society. In this sense, these stories directly and profoundly shape the world despite the fact that most of us think changing the world is beyond our control. In fact, each of us changes the world with our every social interaction!

Now we can circumscribe the fundamental role of story in our lives:

- Story is the fiction of relationship which both forms the basis of our understandings (which are nothing but relationships) and forms the interpretations of our symbolic interactions.

- Story is the means by which the great traditions of inquiry and action are communicated from person to person and generation to generation.
- Story is the Truth of inquiry and wonder in our explorations.
- Story is the dynamic interpretation of meaning in our every *symbolic interaction.*
- Story is the way society regenerates itself built on the always reinterpreted and reformulated great traditions of inquiry and action. That is, story is the means through which the world changes.
- Finally, story is, for all the above reasons, a key tool for the comprehensivist as we strive to make sense of it all and of each other.

Does this circumscribe the fundamental role of story? What are the strengths and weaknesses in this characterization of the role of story? What fundamental role, if any, do you think story provides in our great traditions of inquiry and action, in our comprehensivity, and in our lives?

This essay was written to provide ideas in support of the 16 September 2020 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum:

The 1h 33m video from the 16 September 2020 event

4 The Comprehensive Thinking of R. Buckminster Fuller

07 October 2020 in Resource Center.

Collaborative comprehensivism is participating in groups to incrementally expand the breadth and depth of everyone's understanding. An effective tool for its practice is exploring ideas from a book. Some participants may be unable to read the book. To provide them with a background and to focus on the key passages to be explored at a particular event, it can be helpful to have a brief for the book. Ideally, the brief will highlight questions to guide and spur a group exploration.

To support book-based events with an example, this resource includes a synopsis of R. Buckminster Fuller's 1969 book "Operating Manual for Spaceship Earth". This brief is just one of many possible condensations of the book. It focuses on some of the key ideas that inspired the "Collaborating for Comprehensivism" initiative.

It is common to refer to the author of "Operating Manual" as "Bucky". To read the book, you can find a copy from a bookseller, or read a 44-page PDF at:

https://designsciencelab.com/resources/OperatingManual_BF.pdf, or read a web-based copy at:

https://web.archive.org/web/20041028062223/http://www.futurehi.net/docs/OperatingManual.html. Below there is a section offering advice for readers of the book.

4.1 Comprehensive Thinking

In his 1969 book *Operating Manual for Spaceship Earth*, Bucky Fuller repeatedly surprises us with ways to reimagine our everyday world:

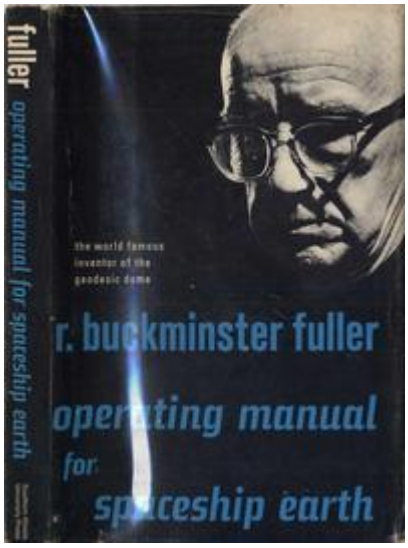


Figure 4.1: Cover of Operating Manual for Spaceship Earth

> I've often heard people say, ``I wonder what it would be like to be on board a spaceship, '' and the answer is very simple. What does it feel like? That's all we have ever experienced. We are all astronauts.
>
> —Buckminster Fuller

The fact is we live aboard a planetary vehicle of 6 quadrillion megatons (5.97237×10^{24} kg = 1.31668×10^{25} lb = 5.97237×10^{15} megatons) with a 25,000-mile equatorial girth ($40,075.017$ km = $24,901.461$ mi) whose diameter is $8,000$ miles ($12,756.2$ km = $7,926.4$ mi). This tiny bit of agglomerated stardust which we call home is orbiting one of about 1024 stars in the observable physical universe. Three-fourths of Earth's surface is covered with shallow puddles of water (10,911.4 m = 35,799 ft = 6.78 miles = 0.09% of Earth's diameter in the Mariana trench) and a thin veneer of atmosphere (100 km = 62 mi = 0.78% of Earth's diameter to the Kármán line). Our spaceship home is transporting us around the Sun at nearly 70,000 mph (29.78 km/s = 107,200 km/h = 66,600 mph) while rotating on its axis at 1,000 mph (0.4651 km/s = 1674.4 km/h = 1,040.4 mph) while hurtling through space with respect to the cosmic microwave background radiation at nearly 1 million mph (390 km/s = 872,405 mph).

The astronautical is just one of Bucky's metaphors in a book which entreats us to engage our comprehensivity, our facility for learning that is "macro-comprehensive and micro-incisive" as Bucky puts it. Some readers of "Operating Manual" may get lost in these stories which can be as disorienting as a fairy tale. What are we to make of a work of non-fiction with so many strange stories from such unusual perspectives?

In a previous essay on The Fundamental Role of Story in Our Lives, I emphasized, in following the ideas of Marina Warner, that fairy tales and mythologies are full of the truths of inquiry and wonder. On almost every page during each of my three re-readings of "Operating Manual" over the past year and a quarter, I too got lost in wondering about these stories. What ideas and values are playing out here? In what sense could Bucky be right? In what sense is he mistaken? What is he getting at? Could I make his point better by telling a different story? Bucky writes wonderful literature, but you need to exercise your creative interpretive skills to make sense of it.

In my reading of "Operating Manual" I learned that children have, as Bucky puts it, "spontaneous and comprehensive curiosity", that Leonardo wasn't just a polymath but a "comprehensively anticipatory design scientist", and that over-specialization is the way to extinction and oblivion (Bucky writes, "[S]pecialization precludes comprehensive thinking"). If we dare to listen to the truths and wonders behind Bucky's mythologizing, we might hear a stern warning about the foolishness of our shortsightedness. Bucky invites us to wonder about the value of a "long distanced ... anticipatory strategy" that might be able to see 25 years into the future. He explains the logic governing automation by writing, "*automation* displaces the *automatons*." Automation can free us of drudgery, so we can become comprehensivists.

We also learn from Bucky:

> Nothing seems to be more prominent about human life than its wanting to understand all and put everything together.
>
> —Buckminster Fuller

This is the creed of the comprehensivist, someone who strives to understand both more extensively and more intensively. It is a basic principle in Bucky's "Operating Manual".

The hinge of the book comes in Chapter 4 where we read:

> Now there is one outstandingly important fact regarding Spaceship Earth, and that is that no instruction book came with it. ... So we were forced, because of a lack of an instruction book, to use our intellect, which is our supreme faculty, to devise scientific experimental procedures and to interpret effectively the significance of the experimental findings.
>
> —Buckminster Fuller

The designations “Spaceship Earth” and “instruction book” suggest that our planet is an intricately designed piece of technology. The materialists and atheists among us may be put off by the thought that our planetary vehicle was designed or invented. Religious people may be put off because they may already have studied our “instruction book”. The ecologically or spiritually minded may think its too technocratic.

For reading and interpreting Bucky, we would do better to set aside these intrusive thoughts. Instead, we should attend to Marina Warner’s great insight that mythologies, like Bucky’s, permit us to explore what may be inaccessible to other kinds of writing. How might we interpret Bucky’s mythology of a Spaceship Earth flying a crew of 8 billion humans through space at nearly 1 million miles per hour without an instruction book?

If we had an instruction book, we wouldn’t need to guess at how Nature works. As it is, we have only our intellect and our experience to guide us in figuring out how the world works. Bucky latches on to “generalized principles” such as “the generalized principle of leverage” that we might discover after realizing that the magic log found while stepping on a crisscrossed fallen tree in the woods can be replaced by any pole that can lift any object if there is a convenient pivot point.

Bucky continues,

> Only as he learned to generalize fundamental principles of physical universe did man learn to use his intellect effectively.
>
> —Buckminster Fuller

A student of David Hume's great book An Enquiry Concerning Human Understanding[1] might object: All we can infer from experience is a "constant conjunction" between an alleged cause and its effect. Our knowledge of "generalized principles" is no more than the custom of repeated attestation creating a confidence in our facts. Hume is correct, there is no principle of reasoning that guarantees the eternal truth of any alleged generalized principle. In fact, history strongly suggests that as our learning becomes ever more sophisticated we will find more and more exceptions and incongruities in our "generalized principles". But again we should read past these intrusive thoughts to realize that Bucky is getting at a deep truth about our learning: finding abstract patterns that recur repeatedly is a basic part of the knowing of every tradition of inquiry and action, including science.

Bucky invites us to expand our comprehensivity by considering the tradition of general systems theory and asking:

> ``How big can we think?'' ...we begin to think of the largest and most comprehensive systems, and try to do so scientifically. ... Can we think of and state adequately and incisively, what we mean by universe? For universe is, inferentially, the biggest system.
>
> —Buckminster Fuller

Before Bucky defines "Universe", he scopes its context as "the biggest system". He is using the word in the sense of the universal set, the set that includes everything that might be considered. Cosmogonists who talk of multiple universes are using the term in the lowercase "u" sense as the speculation that there may be disconnected physical "universes". I capitalize the "U" in "Universe" because, in the Bucky sense, there can only be one "biggest system": it is unique; it is a proper noun.

> I define universe, including both the physical and metaphysical, as follows: ``The universe is the aggregate of all of humanity's consciously-apprehended and communicated experience with the nonsimultaneous, nonidentical, and only partially overlapping, always complementary, weighable and unweighable, ever omni-transforming, event sequences.''
>
> —Buckminster Fuller

1 David Hume *An enquiry concerning the human understanding, and an enquiry concerning the principles of morals*

Thoughts and ideas and even physical principles such as universal gravitation with its inverse square formula are weightless and Bucky abstracts these to comprise the metaphysical part of Universe. This is a different meaning from the philosopher's metaphysics as first principles and different from the spiritualist's metaphysics of a supersensual world. Metaphysics, in the Bucky sense, includes the non-physical, weightless, and ethereal, it includes ideas, theories, descriptions, and principles.

Notice that the center of Bucky's definition of Universe is "communicated experience". That is basically what I mean by traditions of inquiry and action which are all about communication from person to person and generation to generation. The crux of Bucky's Universe is more or less the traditions of inquiry and action which I identified as encompassing the knowing of the comprehensivist. Likewise, Bucky's Universe encompasses all that we can knowingly talk about.

Bucky's framing as "Universe" appeals to my mathematical sense: it is all-inclusive but with an experiential focus. The framing as "traditions of inquiry and action" emphasizes the social and historical and so puts experience in its socio-cultural-historical context.

Despite these differences, I claim that these two formulations—Bucky's Universe and Humanity's great traditions of inquiry and action—are synonymous. Bucky's concept of Universe as "the aggregate of all of humanity's consciously-apprehended and communicated experience" scopes the range of all that we can know. Universe is the ken of the comprehensivist. That is exactly the conclusion I reached about Humanity's traditions. Both Bucky's Universe and traditions of inquiry and action include all that can be communicated. So, my vision of comprehensivism is, in fact, Bucky's vision: we just use different framings.

In Bucky's Comprehensive Thinking, it is recommended that we start our inquiry with Universe, so we do not leave anything out. We then subdivide to isolate the system we want to consider.

> A system subdivides universe into all the universe outside the system (macrocosm) and all the rest of the universe which is inside the system (microcosm) with the exception of the minor fraction of universe which constitutes the system itself.
>
> —Buckminster Fuller

It may take many subdivisions, as in the game of 20 questions, to identify the subsystem with which we are concerned. One benefit of this approach is that the full context is included in our inquiry itself. This is Bucky's approach of Comprehensive Thinking.

Other traditions of inquiry and action may use other ways to pursue their inquiry. To be broadly comprehensive, we ought to consider and assess these other approaches too. But here our aim is to summarize Bucky's approach as presented in *Operating Manual for Spaceship Earth*: systems thinking starts with Universe and divides into the subsystems of relevance for this inquiry.

From this introduction, what do you think of the Comprehensive Thinking of R. Buckminster Fuller? What are the strengths of this kind of thinking? What are its weaknesses or deficiencies?

4.2 Regenerative Evolution of Spaceship Earth

Another important feature of Bucky's Comprehensive Thinking is his nuanced approach to synergy:

> Synergy is the only word in our language that means behavior of whole systems unpredicted by the separately observed behaviors of any of the system's separate parts or any subassembly of the system's parts. There is nothing in the chemistry of a toenail that predicts the existence of a human being.
>
> —Buckminster Fuller

Bucky suggests that synergy is inherent in all systems. This principle of omnipresent synergy justifies starting with the Universe and subdividing: otherwise we risk overlooking the synergetic effects that are part of the context, part of the larger wholes, but invisible within each subsystem. I think it is this feature of the principle of synergy that makes the following Bucky assertion so penetrating:

> ``We have not been seeing our Spaceship Earth as an integrally designed machine which to be persistently successful must be comprehended and serviced in total.''
>
> —Buckminster Fuller

Another reason for managing the Earth system comprehensively is the dynamical nature of Bucky's definition of Universe. Recall that the subject of our communicated experiences is "nonsimultaneous, nonidentical, and only partially overlapping, always complementary, weighable and unweighable, ever omni-transforming, event sequences". The Universe is, as Bucky puts it, "an evolutionary-process scenario". As such, Bucky's phrase "inexorable evolution" is the design process of Universe unfolding to form the events of our experience in perpetuity. This further supports the idea that to successfully manage the omni-transforming scenarios of Spaceship Earth, we must comprehend and service the total Earth system synergetically.

Bucky's system of Comprehensive Thinking includes general systems theory with its topologies of interrelationships and its geodesics or minimal energy pathways. This is a powerful conceptual toolkit. Applying it to the understanding and servicing of our spaceship, we realize that since Earth's resources are unevenly distributed, a global industrial system as "a world-around-energy-networked complex of tools" had to be invented to give Humanity the ability to take care of the vast and vital metabolic needs of Spaceship Earth and its crew.

In Bucky's vision, as stewards of our Spaceship Earth, we have a primary function to organize our know-how and know-what to operate our spaceship as an ongoing regenerative evolutionary process. This kind of Comprehensive Thinking is needed to comprehend and service our spaceship in total. We may even begin to see our planetary function as a "metabolic regeneration organism" as Bucky puts it. The "regenerative landscape" of future possibilities awaits our design attention to imagine and create our regenerative evolutionary future.

What do you think of Bucky's way of connecting his Comprehensive Thinking to the regenerative metabolic futures of Spaceship Earth? What are the merits of this approach? What are its deficiencies?

4.3 Comprehensivism: Putting Bucky's Comprehensive Thinking in Context

Among the many reasons I wrote the above brief for Bucky's "Operating Manual for Spaceship Earth" was to complete a four-part introduction to my vision for *comprehensivism*, the practice of the art of ever broadening and deepening our understanding of it all. The impetus for this introduction to comprehensivism has been the opportunity to organize topics for Comprehensivist Wednesdays.

In this essay, I connected Bucky's Comprehensive Thinking with comprehensivism. I linked Bucky's notion of Universe to Humanity's great traditions of inquiry and action. Bucky's Comprehensive Thinking and his notion of regenerative evolution, which I consider to be the interlinked dual theses of "Operating Manual", comprise what I called The Necessities of Comprehensivism. Although Bucky may have appreciated what that essay calls the impossibilities of comprehensivism, to my knowledge, he never distinguished those concerns. My characterization of the fundamental role of story in our lives was my attempt to capture the role of story as the central "communicated experience" in Bucky's definition of Universe and in the traditions of inquiry and action. That essay also helped me explain the value of the mythologizing in Bucky's "Operating Manual for Spaceship Earth".

The integrated significance of these four essays is to show how my vision of comprehensivism is the identification and abstracting of a significant piece of Bucky's system of comprehensive thinking as documented in *Operating Manual for Spaceship Earth"*. Specifically, I pulled out Bucky's word "comprehensivity" and turned it into collaborative comprehensivism, a group learning initiative.

There are a few differences between my vision and Bucky's. I think we should consider all of Humanity's traditions of inquiry and action and not insist, pedantically, as Bucky sometimes did, that we must always start with Universe and subdivide. I think exploring other traditions and other approaches to inquiry ought to be part of collaborative comprehensivism.

Universalist traditions, like Bucky's full system of comprehensive thinking (which he termed "Synergetics" in his magnum opus), tend to adopt language claiming that their approach is the only one that explains everything. I am very sensitive to the arrogant, imperial, and colonial violence of such claims. With all assertions as with fairy tales, we should wonder and explore how true such claims may be without kowtowing to their strident certainties.

I think comprehensivism should engage all traditions and not be co-opted by any one of them, not even Bucky's, not even science, not even the one true religion. Collaborative Comprehensivism ought to provide a safe space where everyone can thoroughly explore each other's traditions, even those with arrogant universalist claims. Certainty destroys exploration and dialogue. We can wonder about universalist certainties, but we must suspend certainty to boldly examine each idea in a productive dialogue where all voices are heard.

In addition, I wrote this essay to exemplify writing a synopsis for a book resource to help others organize events or groups to develop the practice of *collaborative comprehensivism*, the attempt to understand it all through extensive and intensive explorations of various topics in group dialogue. If you would like to organize such groups or events, consider reading the How To Get Started section of the "Collaborating for Comprehensivism" site. Please Contact Us if you have further questions or comments about organizing your own event or group.

Most proximally, I wrote this essay to provide ideas in support of the 14 October 2020 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum:

1h 40m video from the 14 October 2020 event

Suggestions for Reading "Operating Manual for Spaceship Earth"

Because Bucky deeply challenges our conventional wisdom, many of his stories and assertions can seem odd-ball or even wrong at first. Challenging writers require us to exercise our imaginative faculty to creatively find a reasonable interpretation. Most of the time you can find an interpretation that has an integrity and a truth to it, partial though it may be. Though Bucky makes some factual errors such as "Reiman" should be "Riemann" and he was German, not Hindu.

Another challenging aspect of Bucky's writing is its poetic quality: the full meaning cannot be grasped by looking at what is said literally and atomically. If you work at it by thinking through alternative possible interpretations and by integrating his disparate ideas together, the writing can call forth a deeper integrated meaning. Bucky's writing is a visionary account poetically evoking a new way of perceiving and conceiving of our relationship with Universe.

I invite you to exercise your imaginative faculties to find a way to see each of Bucky's ideas from a perspective in which you can recognize at least a hint of truth. Strive to identify the perspectives the author is inviting us to consider.

For a first reading, I recommend trying to glimpse Bucky's overall world view and his sense of comprehensivity. Try to see if and how his Big Picture approach has some intriguing insights temporarily setting aside those places where he seems off base. If you are interested in a deeper dive, read it multiple times mulling over each phrase using the methods of a hermeneutic circle. *Operating Manual for Spaceship Earth* is good literature: its complexities reward multiple re-readings.

If you are as fascinated by “Operating Manual” as I am, you might also want to read my essay A Synopsis of “Operating Manual for Spaceship Earth” by Buckminster Fuller which provides a partially overlapping but substantially different summary of the book.

5 The Value of The Ethnosphere

09 November 2020 in Resource Center.

This resource condenses, contextualizes, and explores a nearly two-hour video featuring Wade Davis to exemplify a way to open the world of video lectures to people pursuing collaborative comprehensivism, learning in groups to understand the world ever more extensively and ever more intensively. It examines a poignant topic that reveals an important source of learning for comprehensivists. It further illuminates fundamental issues involved in establishing the new tradition of comprehensivism.

This enthralling Wade Davis presentation is itself a condensation of five 2009 Massey Lectures which were published as the book "The Wayfinders: Why Ancient Wisdom Matters in the Modern World".

5.1 The Value of Other Ways of Knowing, Doing, and Being

Wade Davis introduces the concept of the Ethnosphere as the cultural analogue of the biosphere, the zone of all biological life. So the Ethnosphere is the zone of the cultural lives of all peoples. In the highlighted video, Davis reflects on his travels in the Ethnosphere. From him, we learn the value of many ways of knowing, doing, and being of peoples all around the world.

We learn that the Polynesians navigated nearly one fifth of the Earth's surface before the first crusade (late in the eleventh century) including the widely separated Hawai'i, Rapa Nui (Easter Island), and Aotearoa (New Zealand) in the Pacific well before radio let alone GPS and without a marine chronometer, sextant, or compass. Davis explains that Polynesian sailors "can sense the presence of distant atolls of islands beyond the

visible horizon simply by watching and studying the reverberation of waves across the hull of the vessel knowing full well that every island group in the Pacific has its own unique refractive pattern that can be read with the same perspicacity with which a forensic scientist would read a fingerprint."

What incredible know-how and without the technologies our tradition depends on for navigation!

We learn from Davis the vital importance of sharing among the Penan who were the last hunter-gatherers in Malaysia before they were forced to settle. We learn how the Inuit creatively use the cold as a technology for life. We learn how Vodou acolytes convene with the dead in acts that defy pain.

We learn from Davis that Tibetan Buddhism is the "science of the mind" for "what is science but the empirical pursuit of the truth, what is Buddhism but 2500 years of direct observation as to the nature of mind."

We learn that the Amazon isn't a dark Jungle whose biodiversity sits on top of poor soil, but the home to a once thriving civilization of many millions whose descendants, the peoples of the Anaconda, know how to farm sustainably as they have cultivated a dark, fertile soil many meters thick.

We learn about the work of ethnobotantists, like Wade Davis himself, who have brought to our science knowledge of drugs and medicines that indigenous peoples have used for ages.

Davis explains that ayahuasca, the vine of the soul, "is actually a combination of the leaves … of a nondescript plant in the coffee family, chock-full of tryptamines, and the bark of a nondescript woody liana filled with these curious □-Carbolines harmine and harmaline which turned out to be MAO [monoamine oxidases] inhibitors of the precise sort necessary to potentiate the tryptamines."

Davis then asks, "How in a flora of 80,000 species of vascular plants, did the indigenous peoples learn to combine these two morphologically distinct denizens of the rainforest in this powerful synergistic way?" Given the astronomical number of possible combinations, it is not possible to have been luck or trial-and-error discovery. Not only did we harvest potatoes, tomatoes, and maize from indigenous knowledge, but many if not most of our drugs have been acquired from indigenous knowledge co-opted by science with the plagiarism "we derived it from extracts of the rainforests".

Given that our science still cannot explain many of these, evidently superior ways of knowing, it is arrogant, imperial, and colonial to assume that somehow our progress is greater than theirs. As Davis observes, each of Earth's peoples had between 2500 and 3500 generations since the great diaspora from Africa some 50–70,000 years ago. All Earth's peoples have had the same number of generations to form their cultures, they are all equally advanced! As Wade Davis emphasizes,

> The other peoples of the world are not failed attempts at being us, they are unique answers to this fundamental question `What does it mean to be human and alive?'
>
> —Wade Davis

The British knew about the Aborigines when they started settling in Australia in 1788. Since they could not see the indigenous dwellings in the bush, they arrogantly and imperially assumed terra nullius, literally nobody's land, which by European colonial ethics could be seized without cause. To survive in the bush the indigenous Australians did not need the kind of structures Europeans recognized as worthy of land rights. Pray tell, what kind of arrogance is it to fail to realize that knowing how to survive naked in the bush without any provisions is more useful, more resilient, and less expensive than requiring multiple supply lines to survive in an unfamiliar place half a world from home?

We learn from Wade Davis,

> A language, by definition, is a flash of the human spirit. It's a vehicle through which the soul of each particular culture comes into the material realm. Every language [...] is an old growth forest of the mind, a watershed of thought, an ecosystem of social, spiritual, political possibilities.
>
> —Wade Davis

Each language is a way of knowing and being in the world. But Davis warns that many languages are no longer taught to children and will likely vanish along with the unique insights they provided into the possibilities of being human. Our cultural heritage is always fragile and tenuous.

We learn from Davis about "sacred geography" where the potency of one's beliefs affects one's relationship with place. So cultures that see the Earth as alive with mutual spiritual obligations between people and the sacred beings of mountains, forests, and streams engender a profound reverence for geography where our moral system sees only profitable ore, board feet of timber, and bottled water. This is the front line of the great ongoing colonial battle between the freedom of the corporate person to do whatever is legal versus the freedom of a people to live their sacred values on their own terms.

What is the integrated meaning of these and the other stories Wade Davis shares in his Long Now presentation, which condensed his five Massey Lectures? Davis observes,

> It's culture that allows us to make sense out of sensation, to find order and meaning in the Universe.
>
> —Wade Davis

It is not science, but culture that defines the heart of human knowing, doing, and being. Davis emphasizes this realization with his definition of the Ethnosphere:

> the sum total of all thoughts and dreams, ideas and myths, intuitions and inspirations brought into being by the human imagination since the dawn of consciousness.
>
> —Wade Davis

What do you think? Is there value in other ways of knowing, doing, and being? Is there value in the Ethnosphere? Do all peoples and all cultures have ways of knowing, doing, and being that we should include, accommodate, and celebrate as we strive to understand it all as comprehensivists?

5.2 Comprehensivism and the Ethnosphere

There are profound consequences in coming to seriously value and appreciate the ancient wisdom recounted by Wade Davis. We may begin to realize that to make our knowledge sound, we need to systematically compare and contrast it with alternative ways of knowing, doing, and being. We need to carefully examine our metaphysical

assumptions (our first principles), our ontological assumptions (the nature of being and the nature of reality), and our epistemic virtues (the values used to judge the reliability of our knowledge) to ensure we are not arrogantly, imperially, colonially, and violently imposing one way of knowing upon others.

For the comprehensivist striving to understand our worlds and its peoples, the Ethnosphere provides a comprehensive inventory of the wisdom and possibilities we need to assess and evaluate our knowledge in the broadest context possible. Gradually, we may realize that the Ethnosphere provides this vital resource for any effort to comprehensively "understand all and put everything together" as Buckminster Fuller put it. The Ethnosphere delimits the scope of our comprehensivist learning. Suddenly, we realize the Ethnosphere is the source of all our comprehensivist knowing.

But, in the resource Humanity's great traditions of inquiry and action the source of comprehensivist knowing was given as all Humanity's traditions which are communicated from person to person and generation to generation. Is Davis' definition of the Ethnosphere as "the sum total of all thoughts and dreams, ideas and myths, intuitions and inspirations brought into being by the human imagination since the dawn of consciousness" equivalent to the notion of Humanity's great traditions of inquiry and action?

And, in the resource The Comprehensive Thinking of R. Buckminster Fuller, we scoped the range of comprehensivist knowing with Bucky's definition of Universe as "the aggregate of all of humanity's consciously-apprehended and communicated experience".

So, we now have these three proposed ways to scope the knowing of the comprehensivist. Are these three equivalent? What are the differences among them? How are we to characterize the sources for comprehensivist learning?

As aspiring comprehensivists, we need to know where we might look for our data, our evidence, and our ideas. We need to know the kinds of working objects used in comprehensivist inquiry and action. We need to know the tools available for building our nascent tradition. There is no established tradition of comprehensivism to consult. There is no instruction book to consult. We are the pioneers of this new tradition.

Can we determine the source of our learning theoretically? Or do we need to figure it out empirically by organizing dozens of groups each pursuing comprehensivism in their own way so we can eventually assess their relative merits?

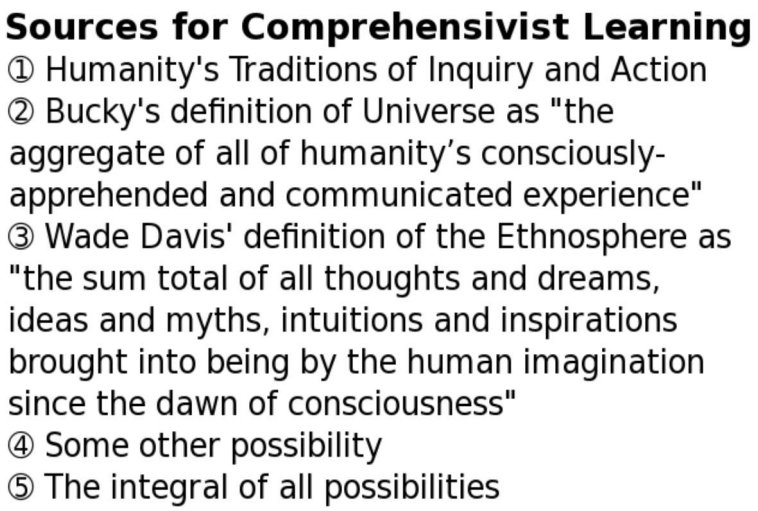


Figure 5.1: Range of Comprehensivist Knowing

How are we to forge comprehensivism as a new practice, a new tradition of inquiry and action? What sources for our learning should we consider? Should we prefer the prosaic "traditions of inquiry and action"? Should we prefer Bucky's cosmic intellectual Universe? Should we prefer the enchanting Ethnosphere of Wade Davis? Are all three sources essentially the same? What differences are there between them? Should we search for yet another approach? Should we engage all possibilities as an integral source?

I do not yet see a crystal clear answer. So, let's collaborate to forge the answer together. What are your insights for better identifying the sources for comprehensivist learning? What do you think?

This essay was written to provide ideas in support of the 18 November 2020 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 1h 30m video from the 18 November 2020 event:

5.3 Expanding Our Resource Center

The Collaborating for Comprehensivism Resource Center provides essays like the one above to foster the formation of a new tradition of inquiry and action that strives to consider with ever-increasing depth and breadth more and more of Humanity's great traditions of inquiry and action, more and more of the Ethnosphere, and more and more of the Universe of all Humanity's communicated experience.

Condensations of video lectures as provided in this resource enable participants to explore a topic in more depth by highlighting and contextualizing key ideas for focused group examination. In a previous resource, we exemplified condensing a book for the same purpose. We hope these resources inspire you to participate in or organize a session to foster our comprehensivity, our facility for learning that is "macro-comprehensive and micro-incisive" as Buckminster Fuller puts it.

6 The Value of Multiple Working Hypotheses

07 December 2020 in Resource Center.

This resource summarizes and interprets a short essay published in 1890 by T. C. Chamberlin to exemplify how we can engage primary resources from scholarly periodicals for the learning of collaborative comprehensivism, learning in groups to comprehensively comprehend our worlds and its peoples. We will see that Chamberlin's paper expounds the benefits and drawbacks of an important moral reform for our lives, namely, the value of multiple working hypotheses. We will then assess the implications of this moral reform for comprehensivist learning.

You can read Chamberlin's paper in a six-page 1965 reprint at:
http://webhome.auburn.edu/~tds0009/Articles/Chamberlain%201965.pdf or on JSTOR (requires a free account) at https://www.jstor.org/stable/1716334 or you can read the original five-page 1890 version on JSTOR at:
https://www.jstor.org/stable/1764336.

6.1 The Moral Reform of Multiple Working Hypotheses

To develop our comprehensivism, our efforts toward learning that are "macro-comprehensive and micro-incisive" as Bucky Fuller put it in "Operating Manual for Spaceship Earth", we first need to find sources for our knowledge. In other resources, we have identified three sources for comprehensivist learning: Humanity's great traditions of inquiry and action, Bucky Fuller's Universe as "the aggregate of all of humanity's consciously-apprehended and communicated experience", and Wade Davis' Ethnosphere as "the sum total of all thoughts and dreams, ideas and myths, intuitions and inspirations brought into being by the human imagination since the dawn of consciousness."

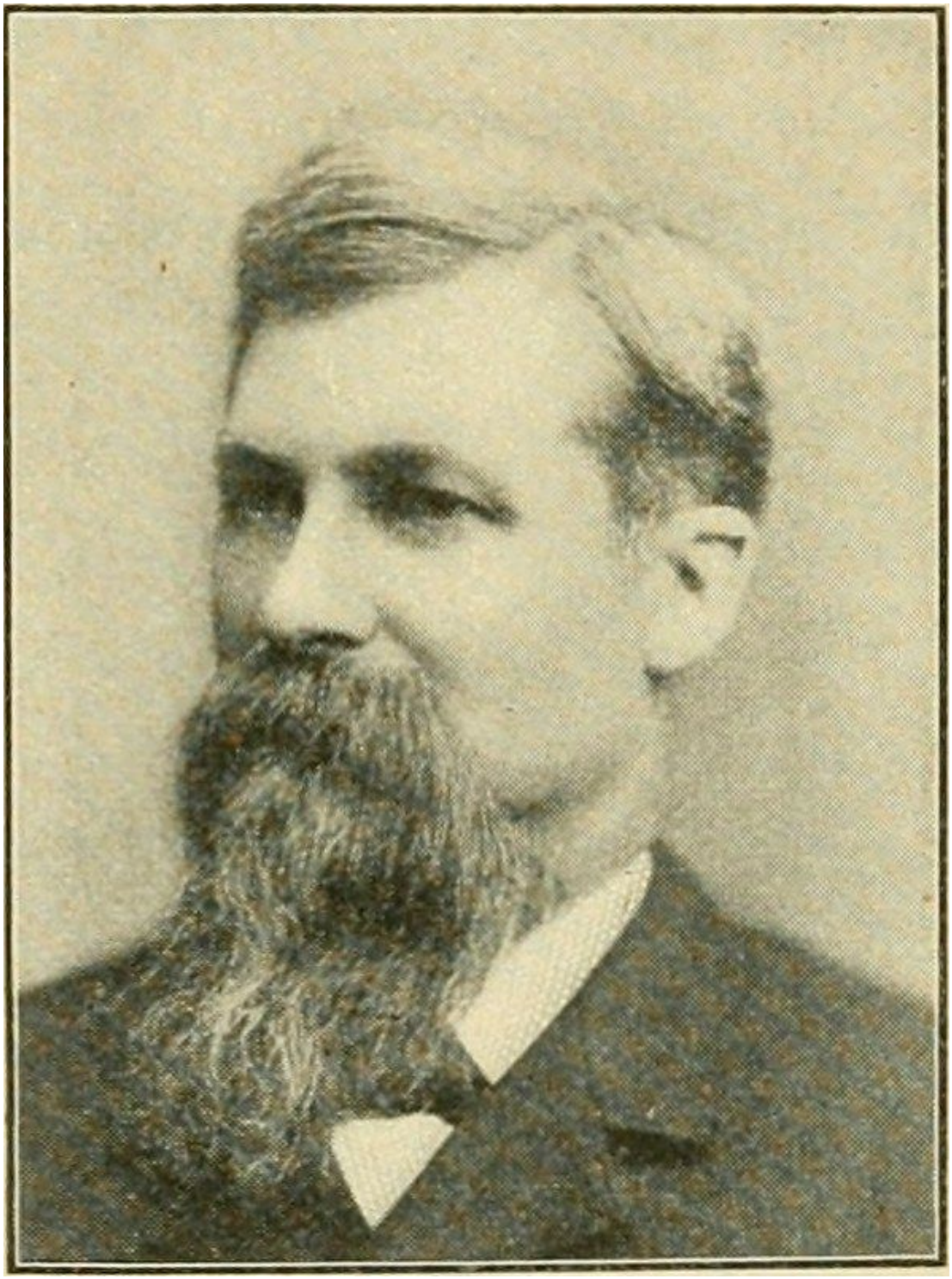


Figure 6.1: T. C. Chamberlin (1843–1928)

In brief, Humanity's traditions, the cosmic intellectual Universe of Bucky, and the Ethnosphere are the so-far-identified sources for our comprehensivist learning. From this enormous inventory of available wisdom, the aspiring comprehensivist now desires moral guidance to navigate and make sense of our vast cultural heritage.

How are we to integrate all this knowledge? Should we accept it all? Should we reject some of it? How should we assess our rapidly growing knowledge? To guide us in answering these questions, we would be aided by having criteria for reliable, dependable, or advantageous knowledge. Such criteria are called epistemic virtues. Warning signs for suspicious, unreliable, or dangerous knowledge are called epistemic vices. In order to make sound interpretations and judgments about the knowledge we, as comprehensivists, are rapidly accumulating, we need competent moral guidance.

This resource will focus on the moral reform urged by T. C. Chamberlin (1843–1928) in his 1890 essay "The Method of Multiple Working Hypotheses". He indicates that it broadly applies to "investigation, instruction, and citizenship".

Chamberlin asserts that "the thoroughness, the completeness, the all-sidedness, the impartiality" should guide the moral sense of our investigations. These are also epistemic virtues for comprehensivism.

Chamberlin presents his method as the highest approach to learning yet attained. I am not convinced of the incisiveness of his history of intellectual methods with its two predecessors, the ruling theory and the working hypothesis. However, as we will see, his application of this rhetorical device to critique these alternative epistemic virtues is powerfully apt.

In the epistemic virtue of the ruling theory, the investigator, the student, and the citizen choose their knowledge by adopting a ruling theory as their faithfully abided by true explanation. In the working hypothesis we adopt, provisionally, a proposed theory as our tentative but preferred explanation.

Chamberlin strongly criticizes both methods for suffering from the epistemic vice of "precipitate explanation", theories put together with insufficient deliberation. It is a common affliction to this day. I, myself, admit to falling for this all-too-common vice from time-to-time. I'm sure you have been induced to premature conclusions as well.

Chamberlin diagnoses the epistemic vice of "precipitate explanation" as "the partiality of intellectual parentage" which we would now call *confirmation bias*:

> The moment one has offered an original explanation for a phenomenon which seems satisfactory, that moment affection for his intellectual child springs into existence... There is an unconscious selection and magnifying of the phenomena that fall into harmony with the theory and support it, and an unconscious neglect of those that fail of coincidence.... There spring up, also, an unconscious pressing of the theory to make it fit the facts, and a pressing of the facts to make them fit the theory.
>
> —T. C. Chamberlin

Chamberlin highlighted the learner who is devising their own novel explanations, but the same vice afflicts those who adopt the explanations of others as their ruling theory or working hypothesis. It is our affection for a theory or hypothesis that signals a dangerous epistemic vice which he characterizes as follows:

> If I were to name the central psychological fault, I should say that it was the admission of intellectual affection to the place that should be dominated by impartial intellectual rectitude.
>
> —T. C. Chamberlin

Chamberlin has identified the epistemic vice of "intellectual affection" as a great danger in our investigations, in our learning, and in our civic life. It is the identification of epistemic vices that tends to spur researchers to new and better ways of knowing as Lorraine Daston and Peter Galison observe in their 2007 book "Objectivity". Likewise, Chamberlin's great advance in improving the scientific method also sprang from the recognition of an epistemic vice.

Chamberlin next proposes a remedy for the dangers of intellectual affection. His *method of multiple working hypotheses* impartially divides our affection among a family of possible explanations. If we diligently and conscientiously follow this method, our investigations may achieve an improved thoroughness and incisiveness of analysis, as Chamberlin argues:

> If all rational hypotheses relating to a subject are worked co-equally, thoroughness is the presumptive result, in the very nature of the case. In the use of the multiple methods, the re-action of one hypothesis upon another tends to amplify the recognized scope of each, and their mutual conflicts whet the discriminative edge of each. The analytic process, the development and demonstration of criteria, and the sharpening of the discrimination, receive powerful impulse from the co-ordinate working of several hypotheses.
>
> —T. C. Chamberlin

Chamberlin summarizes the benefits as follows:

> When faithfully pursued for a period of years, [the method of multiple working hypotheses] develops a habit of thought analogous to the method itself, which may be designated a habit of parallel or complex thought. ... The procedure is complex, and the mind appears to become possessed of the power of simultaneous vision from different standpoints. Phenomena appear to become capable of being viewed analytically and synthetically at once.
>
> —T. C. Chamberlin

This is a powerful benefits statement for the faculties of parallel and complex thought, "simultaneous vision from different standpoints", and viewing phenomena "analytically and synthetically at once". The investigator, the student, the citizen, and the comprehensivist would significantly improve their mental acuity if they could achieve this mental dexterity!

Chamberlin warns of some drawbacks to the method. Since our language and procedures are predominantly linear, there are difficulties in expressing and investigating multiple hypotheses in a co-equal manner. Moreover, the process of weighing evidence for and against each of our multiple hypotheses "may degenerate into unwarranted vacillation".

Chamberlin recommends his method beyond the sphere of investigation and learning:

> I am confident, therefore, that the general application of this method to the affairs of social and civic life would go far to remove those misunderstandings, misjudgments, and misrepresentations which constitute so pervasive an evil in our social and our political atmospheres, the source of immeasurable suffering to the best and most sensitive souls.
>
> —T. C. Chamberlin

Chamberlin concludes with a strong benefits statement for the method of multiple working hypotheses:

> The total outcome is greater care in ascertaining the facts, and greater discrimination and caution in drawing conclusions.
>
> —T. C. Chamberlin

Chamberlin has made his case, we need to assess its merits. Ought we reform our morality by adopting multiple working hypotheses as an important epistemic virtue guiding our assessment of knowledge? Why? Or why not?

6.2 Multiple Working Hypotheses and Comprehensivism

What is the value of Chamberlin's method of multiple working hypotheses for someone practicing comprehensivism, working to ever more extensively and ever more intensively understand it all and each other?

I've already indicated how Chamberlin advocates for important qualities of comprehensivism. In particular, he emphasizes "the thoroughness, the completeness, the all-sidedness, the impartiality". These are important epistemic virtues guiding our comprehensivism as well.

In addition, consider Chamberlin's multiperspectival benefits statement for multiple working hypotheses, namely, that "the power of simultaneous vision from different standpoints [where] phenomena [can be] viewed analytically and synthetically at once." Analytic means intensively focusing on the parts in depth and synthetic means extensively integrating the parts as a broadly considered whole. This is a powerful statement in support of the depth and breadth of comprehensivism though it fails to integrate Buckminster Fuller's principle of synergy (the idea that the behavior of the whole is unpredictable from the behavior of its parts considered separately).

In addition, the method of multiple working hypotheses provides an efficient approach to learning. The comprehensivist guided by this approach can accumulate a large inventory of knowledge from Humanity's traditions, from our communicated experiences, and from the Ethnosphere that can be compared and contrasted to "whet the discriminative edge of each". Contrast this with the usual approach to learning which depends on building knowledge brick upon brick to ensure sound foundations at every step. The comprehensivist approach can produce more options or hypotheses to consider which provides more perspective, flexibility, and resilience.

If we diligently practice handling each of a families of hypotheses co-equally, we will neither overstate them nor lose sight of our ignorance. As we learn more and more and whet the discriminative edge of each against the others, our analytic and synthetic powers may grow. We may develop sophisticated understandings of the interrelationships of a vast array of hypotheses which the more specialized or pedantic learner never considers. We may even develop the ability to ask embarrassing questions of those whose context and experience hasn't enlivened their imaginations with such diverse possibilities.

When this approach is combined with diverse groups of people engaging in dialogue to explore and assess our combined knowledge, our collective understanding may quickly develop new meanings, form new insights, and forge new possibilities. We may find that collaborating to broadly and deeply explore Humanity's accumulated wisdom is more effective than more focused approaches to learning.

This, of course, is the idea of Collaborating for Comprehensivism: to bring a knowledge revolution to our citizenry through learning to make sense of it all and of each other by engaging the sources of comprehensivist learning guided by T. C. Chamberlin's epistemic virtue of multiple working hypotheses.

But, there is a little problem hidden in this aspirational project statement. A basic principle for sound knowledge has been, until now, the assiduous application of the principle of non-contradiction. A comprehensivist co-equally and impartially considering, say atheism and theology, conservative and liberal principles, or even zero as the nothing that exists, runs smack into the problem that the principle of non-contradiction is sometimes in conflict with the principle of multiple hypotheses.

How can we resolve this conflict among our epistemic virtues? I think the answer comes from Buckminster Fuller who said, "Don't try to make me consistent. I am learning all the time."

Learning, investigation, exploration, and civic life are common situations wherein contradictory hypotheses may be encountered and must be co-equally and impartially explored if we are to take Chamberlin's moral guidance seriously. It seems to me that the comprehensivist must learn to accept if not embrace contradictions, otherwise, we may commit the greater harm of prematurely winnowing our hypotheses.

Angela Cotellessa's PhD thesis includes this wonderful quote from Walt Whitman's Song of Myself:

> Do I contradict myself? Very well then I contradict myself; (I am large, I contain multitudes.)
>
> —Walt Whitman

It may be that our aversion to contradictions is misplaced. Forestalling contradictions may short circuit our explorations and compromise our comprehensivist learning. Our predilection for consistency may lead us to over-specialize or otherwise fail to consider the full range of possibilities. Chamberlin's epistemic virtue of multiple working hypotheses may be the more important value for our learning.

In sum, T. C. Chamberlin recommended the epistemic virtue of multiple working hypotheses to better ascertain the facts and to improve our caution and our effectiveness in drawing conclusions. He recommends this approach to increase the thoroughness of our learning, to improve our ability to see from multiple perspectives, and to simultaneously see both analytically and synthetically. He recommends it as broadly applying to our "investigation, instruction, and citizenship".

For the comprehensivist, striving to understand it all and each other, ought the method of multiple working hypotheses be a fundamental epistemic principle for assessing our knowledge? Despite its difficulties in accommodating our linear language and actions? Despite its danger of degenerating "into unwarranted vacillation"? Despite how it may burden us with conflicts, inconsistencies, and contradictions? Despite how it demands that we treat each of our favorite ruling theories and working hypotheses co-equally and impartially by putting them to the test with a battery of additional working hypotheses?

Should we apply the method of multiple working hypotheses as a primary moral principle in the practice of our comprehensivism despite its drawbacks and challenges?

This essay was written to provide ideas in support of the 16 December 2020 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 1h 29m video from the 16 December 2020 event:

The Library of The Comprehensivist

Given its multiperspectivalness, its thoroughness, its integration of analysis and synthesis, and its thoroughness in more effectively drawing conclusions, and despite the fact that it includes a couple of statements against aspects of comprehensivism, T. C. Chamberlin's 1890 essay "The Method of Multiple Working Hypotheses" is a great work for the library of the comprehensivist. I include it with R. Buckminster Fuller's 1969 book "Operating Manual for Spaceship Earth" and Wade Davis' 2009 book "The Wayfinders: Why Ancient Wisdom Matters in the Modern World" in my list of foundational texts for our emerging tradition of comprehensivism, our "wanting to understand all and put everything together" as Bucky put it in "Operating Manual for Spaceship Earth".

7 The Inductive Attitude: A Moral Basis for Science and Comprehensivism

06 January 2021 in Resource Center.

Comprehensivism is an emerging practice that takes seriously Buckminster Fuller's observation that we want "to understand all and put everything together". In this practice, we value learning from other traditions of inquiry and action, all our communicated experiences, and the Ethnosphere, our all-encompassing cultural zone. To assess this learning, we value accumulating and comparing many working hypotheses, conjectures, guesses, theories, and explanations so we can evaluate our vast inventory of knowledge comprehensively.

With these aspirations and values in mind, this resource will consider inductive reasoning as a moral basis for science as examined by George Pólya (1887–1985) in his 1954 public domain book "Mathematics and Plausible Reasoning: Volume I: Induction and Analogy in Mathematics". We will also explore the implications of Pólya's ideas for our comprehensivity, our efforts at learning that are broad in scope and deeply incisive or cutting. For diligent readers who want to assess the relevant parts of Pólya's book on their own, at the end, there is a section with links to its most important and most accessible sections on inductive reasoning.

7.1 Induction as The Moral Basis of Science

In a previous resource on The Value of Multiple Working Hypotheses, we learned the value of considering multiple working hypotheses to sharpen our assessments in investigations, learning, civic life, and for our comprehensivity, the quality of our learning that is ever more extensive and ever more intensive and ever more integrated.

Since the extensive learning of comprehensivism pulls in so much from Humanity's vast cultural heritage, we need *epistemic virtues*, criteria for good knowledge, to aid us in making sense of and assessing all that we have accumulated. What other epistemic virtues might we adopt?

Let's consider George Pólya's 1954 book "Induction and Analogy in Mathematics" which states, "Strictly speaking, all our knowledge ... consists of conjectures." Conjectures are statements or assertions that claim to understand something. They are hypotheses. Pólya emphasizes that they are guesses.

Pólya invites us in: "let us learn guessing". He demonstrates his point, "mathematics in the making resembles any other human knowledge in the making. You have to guess a mathematical theorem before you prove it; you have to guess the idea of the proof before you carry through the details." In this book, mathematics is not a bunch of ex post facto (after the fact) theorems, it is the art of guessing patterns that have not yet been formulated. Pólya claims that all other human knowledge is guessed at and secured in the same way. The question is clear: How can we guess? How can we devise conjectures? How can we hypothesize? This is the art of *induction*.

Pólya writes, "observe that inductive reasoning is a particular case of plausible reasoning". Reasoning is about how to assess or secure our knowledge. Inductive reasoning uses experience to secure our knowledge. Pólya adds, "we support our conjectures by plausible reasoning". So, plausible reasoning is any way to support our knowledge whether it uses experience or not. However, as far as I can tell, inductive and plausible reasoning is synonymous as all reasoning is based on experience.

Pólya's objective in "Induction and Analogy in Mathematics" is to curate and explore examples in mathematics that can teach us skill in the practice and understanding of induction. Indeed, he goes further, he suggests that mathematics provides a laboratory for "investigating induction inductively".

But this book, the sequel to Pólya's delightful and very accessible 1945 book "How To Solve It", is significantly more demanding of the reader's mathematical skills. I have organized 28 Meetup events over the past six years, to explore just the first seven chapters, a mere 120 pages, of the book. Despite its many advanced parts, "Induction and Analogy in Mathematics" makes many accessible and interesting observations about induction. We will focus on the accessible parts of the book that might provide insights into the epistemic virtues we seek.

Pólya provides a powerful but succinct definition of induction:

> [Induction is the endeavor] to extract the most correct belief from a given experience and to gather the most appropriate experience in order to establish the correct belief regarding a given question.
>
> —George Pólya, Chapter 1, p. 3

This is a powerful and incisive statement. Induction has two aspects. First, to extract or guess or infer a conjecture from experience. Second, to survey, seek out, or design experience to establish or support a conjecture. In both cases it is about assessing the correctness of our beliefs, conjectures, hypotheses, guesses, theories, explanations, and descriptions.

In Chapter 1 §4, Pólya explains the inductive attitude. The text is very good and it's in the public domain, so I will quote it at length:

> The inductive attitude. In our personal life, we often cling to illusions. That is, we do not dare to examine certain beliefs which could be easily contradicted by experience, because we are afraid of upsetting our emotional balance. There may be circumstances in which it is not unwise to cling to illusions, but in science we need a very different attitude, the inductive attitude. This attitude aims at adapting our beliefs to our experience as efficiently as possible. It requires a certain preference for what is a matter of fact. It requires a ready ascent from observations to generalizations, and a ready descent from the highest generalizations to the most concrete observations. It requires saying ``maybe'' and ``perhaps'' in a thousand different shades. It requires many other things, especially the following three.
>
> First, we should be ready to revise any one of our beliefs.
>
> Second, we should change a belief when there is a compelling reason to change it.
>
> Third, we should not change a belief wantonly, without some good reason.
>
> These points sound pretty trivial. Yet one needs rather unusual qualities to live up to them.
>
> The first point needs ``intellectual courage.'' You need courage to revise your beliefs. Galileo, challenging the prejudice of his contemporaries and the authority of Aristotle, is a great example of intellectual courage.

> The second point needs ``intellectual honesty.'' To stick to my conjecture that has been clearly contradicted by experience just because it is my conjecture would be dishonest.
>
> The third point needs ``wise restraint.'' To change a belief without serious examination, just for the sake of fashion, for example, would be foolish. Yet we have neither the time nor the strength to examine seriously all our beliefs. Therefore, it is wise to reserve the day's work, our questions, and our active doubts for such beliefs as we can reasonably expect to amend. ``Do not believe anything, but question only what is worth questioning.''
>
> Intellectual courage, intellectual honesty, and wise restraint are the moral qualities of the scientist.
>
> —George Pólya, Chapter 1, p. 7--8

Should we be ready to revise any of our beliefs? Do you have that much intellectual courage?

Should we change our beliefs whenever we discover they are disputed by experience? Do you have that much intellectual honesty?

Should we refrain from changing our beliefs excessively? Do you have the wise restraint to resist changing your beliefs without a good reason?

Should we all adopt this *inductive attitude* as an epistemic virtue guiding our assessment of knowledge?

7.2 The Inductive Attitude and Comprehensivism

We have learned that the *inductive attitude* involves boldly having the intellectual courage to reassess our beliefs when new evidence is found, having the intellectual honesty to change our beliefs when presented with disconfirming evidence, and having sufficient wise restraint to resist changing our beliefs without good evidence. Later on, Pólya explains it this way:

> Induction: adaptation of the mind, adaptation of the language. Induction results in adapting our mind to the facts. When we compare our ideas to the observations, there may be agreement or disagreement. If there is agreement, we feel more confident of our ideas; if there is disagreement, we modify our

> ideas. After repeated modification, our ideas may fit the facts somewhat better. Our first ideas about any new subject are almost bound to be wrong, at least in part; the inductive process gives us a chance to correct them, to adapt them to reality...
>
> Adaptation of the mind may be more or less the same thing as adaptation of the language; at any rate, one goes hand in hand with the other. The progress of science is marked by the progress of terminology.
>
> —George Pólya, Chapter 3, Example and Comment #21, p. 55

This is another powerful and incisive explanation of the process of learning couched in the language of induction, the language of science. It seems like a good epistemic virtue for our comprehensivity, our broad learning about our world and how it works. Until we start looking for evidence among the traditions, cultures, and experiences where comprehensivists look for their knowledge. When we start looking, we find that individual beliefs seem to trump the inductive attitude almost everywhere.

As far as I've been able to determine, each of us espouses and clings to many core beliefs which we would steadfastly refuse to change regardless of evidence. How many of your beliefs do you hold onto so tightly that you would refuse to change them even if the evidence against them seemed strong? Are human beings constitutionally incapable of adapting to experience, observation, and evidence? Is the inductive attitude inhuman and inconsiderate of our stubbornness?

Pólya observed, "There may be circumstances in which it is not unwise to cling to illusions". When we are momentarily confused by unusual circumstances, we rely on our core beliefs to reorient us. When we suffer trauma where our autonomy and truth is denied by others, it may be wise to cling to some hopeful illusions about our worth and dignity. Shouldn't we give people the psychological solace of whatever illusions they may want to cling to? Induction should not be a destructive force crushing our psychological cocoons.

From a comprehensivist perspective, before we adapt our beliefs, we should take into account all our experiences including those that led us to our current beliefs, including our learning from all Humanity's traditions of inquiry and action, from all of the cultures that comprise the Ethnosphere, and from all our communicated experiences in Bucky Fuller's cosmic intellectual conception of Universe. That is, our inductive reasoning should accommodate all our comprehensivist knowing, including any incomplete, intuitive, and ineffable knowing.

I hope that is what Pólya meant, otherwise with a too narrow account of experience, induction can become an imperial force violently separating us from our traditions, our cultural heritage, our friends and family. If we do not want narrowly considered experiences to become a tyranny where induction runs roughshod over people and their cultures, we must take a comprehensive view of experience and soberly accommodate all experience, including the often ineffable bases of beliefs.

This is evidence that Pólya's inductive attitude ought to incorporate the moral reform of T. C. Chamberlin's method of multiple working hypotheses. Then the full array of conjectures considered by the full scope of comprehensivist learning can enrich the exploration and refine our judgment fortified by the discriminative edges of multiple working hypotheses. In my interpretation of Pólya, this is what *wise restraint* entails.

Now we are starting to realize powerful benefits from our comprehensivist approach. Our broad outlook warns us of the dangers of interpreting Pólya too narrowly. Our broad outlook gives us access to more conjectures and more experiences to include in our inductive assessments. Our ready affinity to intensively engage this complexity in depth gives us the wherewithal to practice the wise restraint Pólya recommends.

In considering this comprehensivist context including our practice of engaging multiple working hypotheses and honoring the full breadth of comprehensivist experience, should we adopt Pólya's inductive attitude of adapting our beliefs to our experience as an epistemic virtue providing a moral basis for the practice of comprehensivism?

This essay was written to provide ideas in support of the 13 January 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at hrefhttps://www.meetup.com/thinkingsociety/The Greater Philadelphia Thinking Society).

Addendum: 1h 24m video from the 13 January 2021 event:

7.3 Reading about Induction in Pólya

In case a diligent reader would like to consider reading Pólya's material on induction directly, I recommend the Preface §1–4 and Chapters 1 & 2 as accessible for all readers, except you might skip Chapter 2 §6 unless you are familiar with elementary calculus. Chapters 3 and 4 are excellent but would require a bit of mathematical application to fully appreciate. Regardless, all readers would benefit from reading Chapter 3, Examples 21 & 41 and Chapter 4 §6–7 & Example 26. Although Chapter 5 is advanced mathematically, §5 and the beginning of Example 15 are important and accessible. The rest of the book does not directly address induction, but the subject is always in the background. The book will reward both diligent and casual study: it is a masterpiece of world literature.

Here are links to the relevant sections of the book for readers who just want the highlights (50 pages in total or 30 pages if you skip most of Chapters 3 & 4 as recommended above): §1–4 of the Preface on pages v–viii introduces Pólya's objectives; Chapter 1 on pages 3–8, including Examples 9–14 on pages 9–11. Chapter 2 on pages 12–22, including Examples 5, 7, 10, 11, and 18–20 on pages 23–30, and #46 on page 34. Chapter 3 on pages 35–52 especially Example Problems 21 and 41 in Chapter 3 on pages 55 and 58. Chapter 4 on pages 59–70 especially §7–8 on pages 68–69 and Example 26 on page 73. Chapter 5 §6 "the role of the inductive phase" on pages 83–84 and the first paragraph of Example 15 on p. 87.

8 Mistake Mystique in Learning and in Life

10 February 2021 in Resource Center.

Comprehensivity is our inclination to integrate all our sources of learning so as to better comprehend the world and how it works. To effectively guide our newfound comprehensivity, we require newfound epistemic virtues, new criteria for good knowledge. In previous resources, we have explored two such proposed epistemic virtues: the inductive attitude and the method of multiple working hypotheses.

This resource will investigate *mistake mystique* as a third proposed epistemic virtue for our comprehensivity. Our primary guide for this exploration is R. Buckminster Fuller's essay *Mistake Mystique*. It was published in the now defunct periodical East/West Journal, you can find a copy in some anthologies including "Your Private Sky: Discourse: Buckminster Fuller" edited by Joachim Krausse and Claude Lichtenstein (2001) and Education Automation: Comprehensive Learning for Emergent Humanity published by Lars Muller Publishers (2010). We will also consider some ideas of Stuart Firestein from the 2012 book "Ignorance: How It Drives Science".

8.1 The Value of Mistake Mystique

In the Buckminster Fuller essay *Mistake Mystique* first published in 1977, Bucky, as he is affectionately known, entreats us to adopt the inductive attitude, the discipline of effectively adapting our thinking to our experience:

> From my viewpoint, by far the greatest challenge facing the young people today is that of responding and conforming only to their own most delicately insistent intuitive awarenesses of what the truth seems to them to be as based on their own experiences and not on what others have interpreted to be the truth regarding events of which neither they nor others have experienced-based knowledge.
>
> —Buckminster Fuller

Bucky goes on to warn us against unthinkingly joining fads and other "in" movements, crowd psychology, or group tendencies that might usurp our individual attention to the truth of our experiences and thwart us from adapting our understandings to our experiences.

By highlighting the value of an individual's experience and their intuitive ability to make sense of it, Bucky emphasizes the importance of diversity in forming our collective understandings of the world. Comprehensivism as the emerging practice for coming to understand our worlds ever more broadly and deeply embraces the many different perspectives on offer from the world's many traditions of inquiry and action, our many cultural zones (our Ethnosphere), and the communications of each individual's experiences. By degrees, these learnings percolate through society to become our collective wisdom. It is therefore vitally important to realize that your unique interpretations of your experiences are essential in forming our collective intelligence.

Bucky explains why the inductive attitude is necessary:

> By cosmic designing wisdom we are all born naked, helpless for months, and though superbly equipped cerebrally, utterly lacking in experience, ergo utterly ignorant.
>
> —Buckminster Fuller

This quote is reminiscent of Bucky's explanation in "Operating Manual for Spaceship Earth" that we have only our intellects and our experience with which to learn how the world works. That was the great lesson from Bucky's realization that the "outstandingly important fact regarding Spaceship Earth [is] that no instruction book came with it".

How can we apply our intellects to learn from experience?

[W]hatever humans have learned had to be learned as a consequence only of trial-and-error experience. Humans have learned only through mistakes....

> It is only at the moment of humans' realistic admission to selves of having made a mistake that they are closest to that mysterious integrity governing the universe. Only then are humans able to free themselves of the misconceptions that have brought about their mistakes. With the misconceptions out of the way, they have their first view of the truth and immediately subsequent insights into the significance of the misconception as usually fostered by their pride and vanity, or by unthinking popular accord.
>
> —Buckminster Fuller

Is it true that we cannot learn except through mistake-making? Yes, I think so. Otherwise, we would be either phenomenally lucky or gods who can bypass any errors in concept, interpretation, or practice. Everyone I know is a mistake-maker, just like me, not a god.

With Bucky's help, we suddenly realize that all our knowledge is the collective result of all our mistake-making. That means that all Humanity's great traditions of inquiry and action, all of the practices, rituals, and beliefs that comprise our Ethnosphere (our cultural zones), as well as each individual's communicated experiences are each a towering edifice of learned-only-from-mistakes, experience-won know-what, know-why, and know-how.

In "Mistake Mystique" Bucky presents the wonderful vision of learning as the practice of ever more refined course corrections informed by the ongoing realizations, acknowledgements, and adjustments of our mistake-making. In short, our mistakes provide the essential feedback to guide our knowing and actions to ever more effective results.

Mistake mystique is our profound sense that mistake-making is the crux, the most important part, of our learning. It is a vital epistemic virtue for our comprehensivity because it puts us in direct contact with how we create knowledge at an elemental level.

We can begin to see how our mistake mystique can inform our collective intelligence: your experiences and your mistake-making effectively curated and shared provide inputs for others to refine their understandings. Gradually, a community of people attentively tuned to mistake mystique can develop ever more refined and comprehensively considered learning.

Mistake mystique is, therefore, an important epistemic virtue for our comprehensivity, our "wanting to understand all and put everything together" as Bucky put it in his book "Operating Manual for Spaceship Earth".

So, we should heed the grand moral injunction, from Bucky's book "Synergetics", to guide us toward more effective mistake mystique: "*Dare to be naïve*."

What do you think? Is mistake mystique as the dynamic process of attentively identifying and correcting our mistakes an important epistemic virtue to guide our learning? And our lives?

8.2 The Role of Ignorance

Bucky's virtue of mistake mystique resonates with Stuart Firestein's wonderful short book "Ignorance: How It Drives Science". Firestein begins his book:

> Knowledge is a big subject. Ignorance is bigger. And it is more interesting.
>
> —Stuart Firestein

Firestein provides an image for understanding the relationship between our knowledge and our ignorance: "[Learning is] like the widening ripples on the surface of a pond, the ever larger circumference in touch with more and more of what's outside the circle, the unknown." This insight suggests that knowledge and ignorance are like inside and outside: they always co-exist and co-define each other.

I think this observation resonates with the great Marina Warner insight that stories including fantasy, fairy tale, and myth are a kind of inquiry. I interpret Warner to mean that even fantastic assertions such as we find in fairy tales and myths are, in fact, veiled questions. We might then infer that assertions and questions imply and define each other. Ignorance as questions and inquiry and knowledge as assertions seem to

be two complementary perspectives for our learning: one the inversion of the other. Exploration can be seen as an attempt to clarify the boundary between our ignorance and our knowledge. So exploration might be the mistake mystique feedback loop that Bucky described.

Our ignorance might be seen as the system formed by our questions, our unknowns, and our unknown unknowns. The complement to our ignorance, our knowledge, is the system formed by our guesses, hypotheses, or theories that we posit as known or answers to our questions. In this model, our understanding would be the structure formed by the dynamic connections between our always co-existing ignorance and knowledge. Mistake mystique may then be seen as the epistemic virtue, the tool, that guides us in clarifying the structure of the connections between our ignorance and our knowledge.

As we explore the dynamic boundary between our always co-existing ignorance and knowledge, we suddenly realize that the worlds of our ignorance and knowledge are, in fact, a further source for our learning. As we fill this landscape for exploration with guesses, hypotheses, theories, assumptions, or other kinds of assertions, and we fill it with questions and unknowns, we form the field of our learning. Any such landscape inhabited by questions and their possible answers becomes a new source for our learning.

Could it be that our always co-existing ignorance and knowledge is another source for our learning in support of our comprehensivity, our disposition to compose ever broader and deeper understandings of our worlds and its peoples?

This essay was written to provide ideas in support of the 17 February 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 1h 39m video from the 17 February 2021 event:

8.3 A Theory of Learning for Comprehensivity

We have begun to sketch a theory of learning for our comprehensivity. Let us recapitulate to assess our progress in thinking about how we might understand our worlds ever more extensively and ever more intensively.

Our comprehensivity engages us to understand the world and its peoples. So far, we have identified four sources for this learning. The first source we surveyed was Humanity's great traditions of inquiry and action. Then we examined Bucky Fuller's cosmic intellectual Universe which includes all Humanity's communicated experiences. Next we explored Wade Davis' concept of the Ethnosphere as the full breadth and depth of our cultural zones. Finally, in this resource, we identified the always co-existing and co-defined systems of our ignorance and knowledge as a fourth source for our learning.

There may be other sources for our learning, and there may be better ways to characterize them, but we hope this list of four sources helps practitioners of our nascent tradition begin to get a handle on our project. How would you circumscribe the sources of learning you use to inform your comprehensivity?

In addition to attempting to circumscribe the sources of comprehensivist learning, we have begun the process of attempting to identify the epistemic virtues that should guide us in making sense of all these sources. In this resource we highlighted *mistake mystique*, the value of attending to the ever more refined correcting of our mistake-making. Previously, we identified the inductive attitude as the intellectual courage to be ready to revise any of our beliefs, the intellectual honesty to change our beliefs when our experience disputes them, and the intellectual steadfastness to resist the wanton changing of our beliefs. Finally, we identified the method of multiple working hypotheses as the discipline to consider a wide range of possible explanations before beginning our assessments.

Are these three epistemic virtues a good start in providing us with tools to assess our comprehensivist learning? How might we refine this list? What else do we need to guide our judgment as we attempt to formulate comprehensive comprehensions about our worlds and its peoples?

Addendum: 28m clip from the 17 February 2021 event discussing the epistemology for our comprehensivity:

9 Rethinking Change and Evolution: Is Genesis Ongoing?

10 March 2021 in Resource Center.

There are many ways to approach the development of our comprehensivity, our ways of understanding the world and its peoples through broad and extensive considerations that are also deep and intensive with the aim of forming a more and more complete and integrated comprehension of our worlds. Previous resources engaged essays, papers, video lectures, books, surveys, syntheses, condensations, contextualizations, interpretations, investigations, and explorations. This resource curates a small sampling of ideas in the hopes of stimulating a broader, more comprehensive appreciation of the nature of change, evolution, and design in our conceptuality.

The idea for this resource came from the provocative, revolutionary, and controversial 2012 book *The Design Way: Intentional Change in an Unpredictable World* [NS12] by Harold G. Nelson and Erik Stolterman. I no longer recommend the book because too many of my associates have been unable to appreciate its provocative style. I find the book to be a wellspring of intriguing ideas. Its revolutionary approach in considering design as Humanity's first tradition of inquiry and action is an exemplar for my efforts to create a new tradition for comprehensivism, the practice of our comprehensivity. In addition, this resource will consider ideas from W.E.H. Stanner's essay "The Dreaming" (see a July 2017 event on "The Dreaming and The Songlines" for more notes on Stanner's essay), Dan Everett's studies of the Pirahã people from the "New Yorker" profile by John Colapinto, and Richard Lewontin (see his three presentations for the 2003 Stanisław Ulam Memorial Lectures at the Santa Fe Institute).

9.1 Three Exhibits on Change and Evolution

As we consider our comprehensivity, our interest to broadly and deeply understand our worlds and its peoples, we may wonder: What is the world like? How does it change and evolve?

Two answers to these questions come from the great Greek philosophers Hērákleitos and Parmenídēs who argued, respectively, that all there is change and that change is impossible. As we look to our great traditions, we discover there are many ways to think about change and evolution.

Below I will curate some provocative exemplars to indicate ways in which our comprehensivity may expand our perspective on change. I have highlighted each example as an exhibit. It is the reader's task (or the participant's task in events that present these ideas for a group exploration) to integrate this curation into a meaningful reflection on change and evolution.

9.1.1 Exhibit A: The Everywhen of The Dreaming

To stretch our minds historically and culturally, let's first consider Humanity's longest surviving culture, the Aborigines of Australia with their 50,000-year history. W. E. H. Stanner and other anthropologists have managed to rescue from the devastation of colonialism and genocide some traces and hints of their great culture and its philosophy called *the Dreaming*. Here is Stanner's introduction to the idea:

> ``A central meaning of The Dreaming is that of a sacred, heroic time long ago when man and nature came to be as they are; but neither `time' nor `history' as we understand them is involved in this meaning. I have never been able to discover any Aboriginal word for time as an abstract concept. And the sense of `history' is wholly alien here.... The Dreaming conjures up the notion of a sacred, heroic time of the indefinitely remote past, such a time is also in a sense, still part of the present. One cannot `fix' The Dreaming in time: it was, and is, everywhen.... If I am correct in saying so, it is much more complex philosophically than we have so far realised.
>
> —W.E.H. Stanner, ``The Dreaming'', 1953

I do not know enough about the Dreaming to assess its understanding of change and evolution. But it seems clear to me that any culture with a philosophy that features past and present fused in an everywhen provides important context to appreciate the range of possible ways to conceptualize change and evolution.

To understand change and evolution broadly, must we also understand the various approaches to time as well?

9.1.2 Exhibit B: Living In The Moment with the Pirahã

John Colapinto's fascinating "New Yorker" profile of Dan Everett's research on the Pirahã (pronounced pee-da-HAN) suggests that these are a people who live adeptly in the Amazon in a culture of "living in the moment". They do not care about anything beyond the most recent past.

Everett is a linguist who learned their language to convert them to Christianity. In the process, they converted him to atheism. When he attempted to explain the importance of Christ's life to them, they were interested until he explained that, no, he had never met Jesus because he died a long time ago. From that point on, they had no interest in discussing the life or teaching of someone not of this moment. If the eternal now is the only thing that matters, why should we care about someone who died some 2000 years ago, even if they are our savior?

What can we learn from a people who actually "live in the moment" about the nature of change and evolution? How might change and evolution manifest to such a people? Could they even conceive of the idea? If not, how might that advantage them?

9.1.3 Exhibit C: "Genesis is Ongoing"

The first paragraph on page one of Harold G. Nelson and Erik Stolterman's 2012 book *The Design Way* is provocative:

> Genesis is ongoing. As human beings, we continuously create things that help reshape the reality and essence of the world as we know it. When we create new things—technologies, organizations, processes, environments, ways of thinking, or systems—we engage in design. To come up with an idea of what we think would be an ideal addition to the world, and to give real existence—form, structure, and shape—to that idea, is at the core of design as a human activity.
>
> —The Design Way by Harold G. Nelson and Erik Stolterman

Is genesis ongoing? Is creation ongoing? Are human beings a big part of the ongoing creation in our world?

Should we think of ourselves in the eternal now as actors in the creative process of ongoing genesis? Is this how you think of yourself? Should you be thinking this way?

In general, "genesis" means coming into being. "Genesis" is also the title of the first book in the Hebrew and Christian Bible. But maybe the beginning highlighted in the Bible has distorted our understanding of reality: "in the beginning" might not be the change that matters most.

"In the beginning" is also a story-telling device. It is described by the great Roman poet Horace as "ab ovo" that's Latin for "from the egg" which he denegrates in his "Ars Poetica" (c. 19 BCE) as an inferior way to start an epic. Instead Horace recommends starting in mediās rēs, into the middle of things. That is the approach used in Homer's "Odyssey" and "Illiad", in Virgil's "Aeneid", and in Dante's great "Comedy" (which some of us are reading to celebrate his seventh centennial). Perhaps our great poets and *The Design Way* have it correct: in mediās rēs might be the right way to think of reality. So, is genesis ongoing?

As Heidegger saw it, we are thrown into a world already in progress. Life is presented to newborns and to each of us every day, in mediās rēs, into the middle of things. In mediās rēs is the nature of the reality that we are thrown into at birth and again each and every day after that!

Hērákleitos and Parmenídēs may have gotten it wrong: the spectator's view of whether change exists or not may not be so important. Instead, it might be crucial how we are creating our ongoing reality, right now and into the future. It seems to me we should add "genesis is ongoing" to our ready collection of multiple working hypotheses.

Should we reimagine ourselves as creators and designers of our ongoing genesis? How might we begin to think of ourselves in this profoundly reorienting way?

As you consider these three exhibits from three traditions, what are you drawn to reconsider about the notions of change and evolution? What adjustments might you need to make in your thinking about change and evolution to accommodate the perspective of these exemplars: the everywhen of Aboriginal Dreaming, the Pirahã who live in the moment, and the idea that genesis is ongoing?

9.2 Two More Exhibits on Change and Evolution

Let's continue our investigation into change and evolution by considering two more exhibits. First, we'll examine a few ideas from a major contributor to evolutionary theory in the late 20th century.

9.2.1 Exhibit D: Richard Lewontin's Evolutionary Thinking

In three penetrating 2003 Stanisław Ulam Memorial Lectures, Richard Lewontin explains subtleties in evolutionary thinking to help us critique many of the just-so stories that we often hear touted as evolutionary truth.

Lewontin carefully distinguishes what he calls a *variational theory of evolution* like biological evolution from a *transformational theory of evolution*. He explains the three principles of variational evolution (Darwin's great contribution): 1) there are differences in the traits of individuals (variability), 2) these differences tend to be passed on to future generations (heritability), 3) the rates of reproduction differ among the traits (selection). Any system where mortal individuals are subject to these three principles will evolve by "natural selection" just like the biologicals.

In order to emphasize that there are many types of evolution, Lewontin explains the transformational theory of evolution where each individual transforms along a prescribed path. He gives the examples of stellar evolution (developed by Kant and others long before Darwin) and the greying of a population of classmates from school.

When Lewontin examines cultural evolution in his third lecture he shows that it fails to meet the criteria for either the variational or the transformational models. So cultural evolution is different from either of these alternative models.

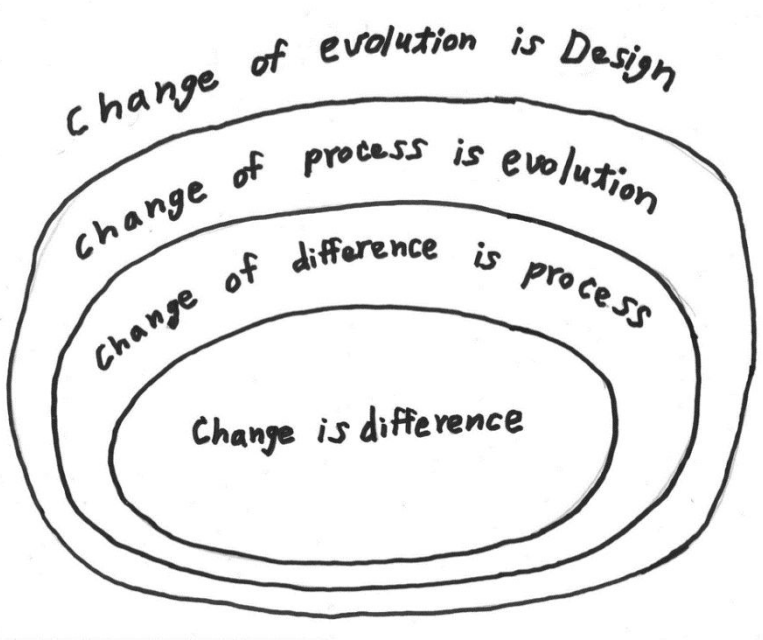


Figure 9.1: Hierarchy of Change adapted from *The Design Way*

Does Lewontin's taxonomy of evolution help us realize that there are many kinds of evolution and so we need to be judicious in applying the right model to the right situation?

9.2.2 Exhibit E: A Four-Tier Hierarchy of Change

The Design Way by Harold G. Nelson and Erik Stolterman presents a very interesting hierarchy of change that I have adapted in the following image:

There are many interesting and provocative inferences we can draw from this image. We start in the center of the image. The core and central notion of change comes from difference which evokes the idea of a distinction. As these distinctions themselves change, they form a process. A change in difference is therefore a process. Evolutionary change is a higher order change, namely, of change in processes. But even evolution is parochial change. The highest order, most significant changes come not from elementary distinctions and differences, not from processes, not from evolution, but from design.

Is design the most overarching form of change there is?

This essay was written to provide ideas in support of the 17 March 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 1h 5m video from the 17 March 2021 event:

9.3 The Curatorial Approach to Comprehensivity

To foster our comprehensivity, we can organize a broad and extensive consideration of a topic, or we can organize a deep and intensive analysis. In addition, we can organize a synthesis (putting many ideas together into an overview), a syntopical overview (a broad survey that deeply compares and contrasts the extant literature), or organize an integrity (an attempt to fully integrate it all). These summary or survey approaches are excellent ways to support our comprehensivity.

In this resource, however, we used a curatorial approach where we took a sampling of exemplars that help us consider aspects of a topic and left it to the reader to integrate them into a broader understanding of change and evolution. What are the benefits and shortcomings of this curatorial approach? Here are some thoughts:

Benefits of the curatorial approach:

- It invites the participant to interpret the exhibits to form a unique and personal meaning. That is, it supports the active development of the skills of synthesis and integration by the participants instead of merely demonstrating them in a summary.
- Neither the participant nor the presenter is required to master the enormity of the whole of a subject and its literature.
- So, it is much less time-consuming and burdensome to curate a set of thoughtful exhibits. Thus, curations may allow more participants to organize more comprehensivist topics.
- It invites participants to imagine their own list of additional exemplars to expand our exploration.
- It can critique ideas indirectly without having to address them head-on in a summary. So, the impact may be greater because the exemplar may be more persuasive than omissions or dismissals in a survey.

- Some ideas may be beyond our current ability to explain using words, symbols, images, dance, or music. The curatorial approach can sometimes gesture towards these ineffables when other approaches fall short.

Shortcomings of the curatorial approach:

Not everyone has the skills to turn examples into comprehensive comprehensions, so curations may fail to guide participants to broader, deeper, or more integrated considerations of the subject.

A curation can foster confirmation bias by presenting too many exemplars that are already established.

Effective curations may require the organizer to present some edgy exemplars that may prove to be so controversial that they distract from the goal of fostering comprehensivity.

Present-day discourse tends to favor grand summaries and broad surveys that present the God's eye perspective and a silver bullet that can, allegedly, explain everything and guide us to a new promised land. So, the less ostentatious and less overtly ambitious curatorial approach may not attract interest given our contemporary bias for boldly assertive claims of profundity and significance.

What do you think of the curatorial approach?

Would you be more comfortable organizing a curation or one of the survey approaches?

10 How to Create That-Which-Is-Not-Yet

06 April 2021 in Resource Center.

To develop our comprehensivity, our interest in broadly and deeply understanding our worlds and its peoples, we actively consider the learning of other traditions, traditions that may seem very strange to us. When we explore these kinds of resources, we may come across ideas that puzzle or intrigue us. The practicing comprehensivist will, from time-to-time, want to linger to explore a line of thought and some questions that arose in a prior exploration. This resource will exemplify such a *follow-up exploration* that extends our previous examination of change as ongoing genesis, ongoing creation. A key motivating issue for this continuation will be *how we create that-which-is-not-yet*. Many of these ideas are adapted from the 2012 book *The Design Way* [NS12] by Harold G. Nelson and Erik Stolterman.

10.1 The Fundamental Role of Design

> Genesis is ongoing.
>
> —Harold G. Nelson and Erik Stolterman The Design Way, pg 1

This quote may precipitate the realization that our ever-changing world creates itself. How might we experience this ongoing genesis?

We might experience the ongoing genesis as a world that just happens: things form and come to be and we become aware of them. To understand such a world, we interpret the changes observed in our ongoing experience. As we organize our interpretations, we form a story we tell ourselves and others about the ongoing happenings. From this stance, the design of the world in its dynamic changing is our ever-developing story about the world as created by our interpretations. That is, the ongoing genesis is our always evolving interpretation of our experiences.

In another approach, we can imagine the new arrangement of things, the new design of the world, as a consequence of our collection of causal beliefs, models, theories, and abstractions about the world. Here we focus on seeing the changing world through the confirmation or collision of our best beliefs about how the world changes with the reality of our experience. This is the causal analytic frame. We perceive the changing design patterns of the world through the lens of our beliefs, models, theories, and abstractions instead of as raw experience data. It is our educated view of reality. The ongoing genesis is embedded in the causal explanations which describe how the designs in the world change.

Yet another approach for experiencing the world and its change as ongoing genesis is to recognize that everything we do in the world changes it. Our actions and how we participate shapes the ongoing genesis. If we fail to act, we create a world filled with watching, waiting, lethargy, and inaction. This approach emphasizes that, like it or not, we are responsible as co-designers for our worlds. Our collaborators include the sun, the moon, volcanoes, eukaryotes including plants and animals and people, bacteria, and archaea. In a global pandemic, I must add viruses too.

In fact, it seems to me that at least these three approaches comprise the ongoing genesis of our world: our ever-evolving interpretations of ever-changing experience, the models and theories we use to understand the changing patterns of our worlds, and the actions we take as we participate as co-designers of ongoing genesis. Each of these approaches contributes to how we create our worlds. Each affects the others in a complex feedback loop.

As we become aware of our design role in ongoing genesis, we might wonder how do we go about creating our worlds? How can we create that-which-is-not-yet?

In my experience, most of us do not think of ourselves as designers. Even less as designers with a world-creating role. But each of us is a designer; we create our worlds in all three of these senses. Your experiences, beliefs, and actions co-create our worlds in collaboration with all the other actors.

Is it possible to live our lives while simultaneously designing them? The book *The Design Way* has a wonderful metaphor for seeing design in precisely this way: "Designing is like laying track for a moving train while on board." Yes, it is almost unimaginably complex.

Is seeing ourselves as co-designers of our worlds the logical implication of seeing the world as ongoing genesis?

Does your participation in the world necessarily make you a designer of the world?

Is this design role an imperative from realizing our ongoing genesis?

What do you think of your creative role in contributing to ongoing genesis?

10.2 The Fundamental Role of Desire

In his interpretation of Purgatorio V in Dante's great "Comedìa", Giuseppe Mazzotta said, "We're impelled by desire, and desire is really what moves us ...it's desire that impels us to go one way or the other." If Mazzotta and Dante are right, desire may be the impulse that leads us to act in the world, to create that-which-is-not-yet. Even if we do something on a whim, even if we regret it later, we would say, "In the moment, I did it for this or that desired outcome".

Is desire the source of all our change-making impulses? Is desire necessarily the impulse to create that-which-is-not-yet? Is desire the trigger for all the big changes we make?

> Desire is the destabilizing trigger for transformational change
>
> —Harold G. Nelson and Erik Stolterman The Design Way, Chapter 5 ``Desiderata''

We may worry that our raw desires might foist themselves unrestrained into our ongoing genesis. Moreover, one desire may run roughshod over others. Many desires if untempered quickly lead to vice. So even though our desires may influence our actions and thereby contribute to ongoing genesis, how can we address how desire can be destructive at times?

To differentiate positive desires from negative ones is one of our lifelong tasks as human beings. Rosaleen Trainor [in a 2001 lecture] has called this process “befriending our desires.” She explains that when we become aware of and comfortable with our desires, they begin to have an accepted place in our lives and can function as a form of guidance.

Must we befriend our desires so they can guide us to create the that-which-is-not-yet that we desire? Instead of our raw desires, is it our befriended or otherwise organized desires that give us the energy and guidance we need to create that-which-is-not-yet?

Desire can be understood as the “force” that provides us with intrinsic guidance and energy.

One way to organize our desires as a guide for effecting our ongoing genesis might be to integrate that-which-is-desired with that-which-is, that-which-ought-to-be, and that-which-feels-right. That is, we might want to think about our situation comprehensively in consideration of our desiderata (our full set of desires), our knowledge, our ethics, and our aesthetics. Since we must co-design our ongoing genesis with others, it seems best to incorporate the desires, knowing, values, and styles of other stakeholders (including, perhaps, future generations) into our desiderata.

> ``desiderata'' refer to those things that are believed to be desirable
>
> —Harold G. Nelson and Erik Stolterman The Design Way

However, *The Design Way* warns us that a comprehensive approach to our design responsibility can lead to inaction or paralysis. They identify three difficulties which a comprehensive approach to design may entail (this list was also the inspiration for the impossibilities discussed in the resource The Necessities and Impossibilities of Comprehensivism):

1. **Analysis Paralysis.** When our desire for understanding our design situation endlessly gathers more and more information without a means for convergence on an effective way to create what is more desirable, then analysis paralysis can block us from achieving what we desire.

2. **Value Paralysis.** When our desire for integrating all of our values and those of other stakeholders into our effort to create change without an effective way of transcending their mutual ambiguities and contradictions, then value paralysis can block us from achieving what we desire.

3. **The Paralysis of Wholism.** When our desire for integrating the full context of everything we are considering into a Big Picture without an effective means to limit or contain our survey, then the paralysis of wholism can block us from achieving what we desire.

Despite these dangers, *The Design Way* recommends that we carefully assess our desiderata as we consider creating that-which-is-not-yet.

> Desiderata form the imperative voice of design.
>
> —Harold G. Nelson and Erik Stolterman The Design Way

Is desire the motivation, the impetus, and the imperative guiding us to create that-which-is-not-yet as we participate in ongoing genesis?

10.3 The Fundamental Role of Intention

Although desire conceived broadly as desiderata is what moves us to create that-which-is-not-yet, *The Design Way* identifies another important aspect of our desiderata:

> Desiderata are about what we intend the world to be
>
> —Harold G. Nelson and Erik Stolterman The Design Way

Even when we are not consciously organizing our desiderata into focused efforts to make intentional change, our desiderata form our intentions. When we create our ongoing genesis through our raw desires, the accidents and whims of our desires shape our lives. By organizing our desiderata into intentions, we give direction to our creative effort to shape our ongoing genesis.

Intention is best understood, not as a vision, but as the aiming and subsequent emergence of a desired outcome. Desiderata help to aim and name one's intentions.... But intention is not only about where to get to, it is also about which direction to go to get there—how to aim so as to move closer in proximity to our desired ends.

We are now able to organize a basic design cycle to answer the question how do we create that-which-is-not-yet in support of our ongoing genesis. We start by assessing our desiderata. This is focused into an intention that gives direction to the change we desire. Then we act in the world. A result emerges in the ongoing genesis that we tried to shape; the result is often different from what we intended. This serves as feedback for another round of assessing our desiderata. The loop iterates until you die.

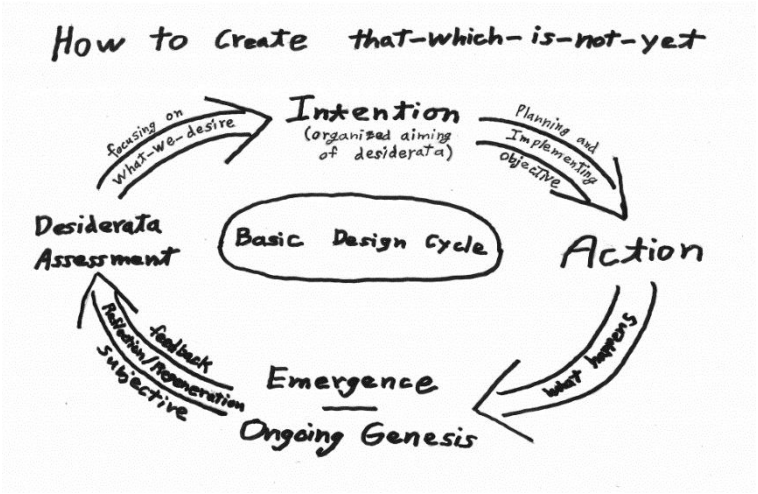


Figure 10.1: Basic Design Cycle: How to create that-which-is-not-yet

I think this model can serve as both a description of the nature of ongoing genesis for each of us: how ongoing change occurs and has always occurred in our lives. But more importantly it is also a guiding model for how we create our lives: assess our relevant desires, organize them into an intention, act in the world, assess how the effects of your actions affect your desiderata (perhaps new desires emerge or maybe a few fade away or the quality and measure of some desires may have changed).

Does this schema for a basic design cycle featuring desiderata assessments organized into intentions both describe and guide us as we contribute to ongoing genesis? What are the strengths and weaknesses of thinking about the change in our lives in this way?

10.4 Conclusion

The basic design cycle centered on desiderata, intention, and action is just one of many possible design cycles that have been proposed. It is much simpler than the ones developed in *The Design Way*. Although this design cycle schema captures what I see as the essential notion of design responsibility in Buckminster Fuller's comprehensive anticipatory design science approach, it uses the language of *The Design Way* instead of Bucky's language. I hope this design schema is satisfactory as a preliminary gloss for Bucky's design science even though it omits many crucial aspects of his approach.

Although I have studied design thinking and I recognize it as a powerful framework for effective design, it does not seem to me to be as general as the model presented here. But, of course, what this model offers in generality it lacks in the depth and power that would be needed to address many professional design challenges let alone truly wicked problems, challenges where desiderata assessments fail to converge on any effective intentions.

My hope is that this essay imparts the imperative of design that each of us faces in our lives and that it shows that getting a basic handle on the design imperative to address the relentless ongoing genesis in our lives is tractable and manageable.

This essay was written to provide ideas in support of the 14 April 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 1h 41m video from the 14 April 2021 event:
https://www.youtube.com/watch?v=66PX2gFATnU

11 How To Explore The Future (and Why)

04 May 2021 in Resource Center.

Futures are our ideas about the future. Futures provide another way for us to assemble and eventually integrate broadly informed multi-perspectival views of our worlds; futures can help us foster our comprehensivity. Moreover, futures can help us better create the future we would desire. This resource will interpret, expand upon, and contextualize the exquisite presentation "Exploring Alternative Futures" by the brilliant young futurist Angela Oguntala.

11.1 What is The Future?

Angela Oguntala's presentation includes illustrated descriptions of many of the ideas we have of the future. She gives examples of the kinds of dystopian and utopian futures that are incessantly repeated in our society including Domesday Jerry who prepares for a "certain" but unknowable catastrophe, Tom Cruise's Minority Report where agents hunt you down for a crime you haven't committed, the 2009 invention of a talking watch which had been the subject of science fiction for decades, a future where scarcity becomes the norm and we need to forage for food to survive, and a utopian society where new technologies provide all imaginable pleasures with no pain, struggle, or work.

> The special thing about the future is that it is loaded. It's a place where we store all of our baggage, our anxieties, our frustrations, our hopes, our excitements and fears. ... So it makes perfect sense that throughout time we have always been mesmerized by the future. [So] we try to predict and we try to speculate what will tomorrow be like when it arrives. ... What we get from these predictions are vision and images and stories that creep into our minds and that stay in our minds for a very long time.
>
> —Angela Oguntala

Oguntala's point is that the future can have a profound hold over our thinking and our actions. She claims that visions of the future are powerful because they inspire us to work toward them. But she worries that when these visions and images and narratives of the future are repeated too often, they begin to limit us, they narrow our scope of possibilities, they bias our measures of other alternatives.

> Should we be more skeptical of the futures presented to us? Should we be more skeptical of the enticing possibilities of our entrepreneurial prospectuses and utopian science fiction? Should we be more skeptical of the often menacing possibilities that fill our news feeds, our dramas, and dystopian science fiction?
>
> How likely is the future that you are so worried about?
>
> All futures are uncertain.... The fundamental concept of future studies ... says that there is no `the future'. There is no `the future' as this thing that sits out here on a timeline and then it just shows up one day. Instead, there are many possible futures and each one has some likelihood of coming to life.
>
> —Angela Oguntala

Oguntala is correct. In my only college history course, "The History of The Future" with W. Warren Wagar, our textbook The Study of The Future edited by Edward Cornish [Cor77] emphasized this way back in 1977: "So far we have discussed 'the future' as if it really existed. But in actual fact, it does not, and we must recognize the non-existence of the future if we are to clarify our thinking about it."

What is the future, really?

What images, visions, and stories of the future have mesmerized you?

How can we break the dangerous spell of mesmerization that some futures hold over us?

11.2 How Should We Explore The Future?

Angela Oguntala recommends exploring alternative futures to improve our understanding of the possibilities the future may hold for us and to gain insights into how our actions may affect the dynamics of the futures we are creating together.

> Our collective job is to imagine … alternative futures for us to pick apart and inspect. So that we can get a good understanding of the kinds of outcomes that we want and the kinds of outcomes that we don't want. But more importantly what are the series of actions and events that will lead us to one alternative versus another.
>
> —Angela Oguntala

Oguntala thinks we can escape the blinding restraints of a few mesmerizing futures by actively thinking in alternatives.

> Our ability to think in alternatives, I believe, is centered on looking for new stories or different ways to tell stories.
>
> —Angela Oguntala

She mentions literature and film. She explains how countless stories in the European tradition follow the hero's journey of trials and tribulations resulting in personal transformation. However, in Nollywood, the Nigerian (and the broader African) film industry, stories preserve tradition. A good example of this formula is the Nollywood film "The Mirror Boy".

> When you take in new kinds of stories and when you really try to understand them in a deep way, however absurd they might seem to you at the start, … it gives you an opportunity to reflect on your own stories that you tell and the formulas that you use to approach the world.
>
> —Angela Oguntala

She then emphasizes the importance of understanding these alternative stories:

> There is a lot of conflict in our world based on the fact that we don't really understand in any kind of a deep way other people's stories. And when we don't understand their stories, we don't understand what their dreams are based on, and then we can't understand what they are working towards.
>
> —Angela Oguntala

She provokes us to imagine how Polynesian society with their deep respect for Nature as a driving force and their principle of cyclical or ancestral time might think about the future? Another way to explore the stories of others is to read science fiction from, for example, the Caribbean to get a new perspective on the possibilities offered by other kinds of stories. She asks,

> What future might a Caribbean culture build? ... What are the stories that Caribbeans tell themselves about what the future could be like based on their own history, traditions, mythology, language?
>
> —Angela Oguntala

She then invites us to consider the world of the Caribbean science fiction novel Midnight Robber by Nalo Hopkinson [Hop00] where

> There was this surveillance robot overlord that watched over the entire planet. It was called `Granny Nanny'. And Granny Nanny didn't really behave like your typical science fictional sinister tropes about surveillance. ... Granny Nanny was some old woman who was a freedom fighter in Jamaica in the 1800s [Oguntala misspoke, she meant 18th century].
>
> —Angela Oguntala

She explains how the cultural heritage of Jamaica gives an entirely new perspective on surveillance overlords. She abstracts these examples to form a basic principle of thinking in alternatives to better inform our exploration of the future:

> Stories matter. And new or different kinds of stories than what you are used to will give you an opportunity to reevaluate your own mental models and your own assumptions. And that sits at the core of thinking in alternatives.
>
> —Angela Oguntala

Chimamanda Ngozi Adichie explains the value of having many stories.

One of the ways in which I have been broadening my awareness of alternative stories is by exploring the treasure trove of books collected by Ann Morgan starting in 2012 when she read a book from each of the 196 countries of the world. Her country-by-country list and reviews of international literature translated into English are at https://ayearofreadingtheworld.com/. She continues to review books from around the world and adds them to her growing site. Her list provides a guide for sampling the wide diversity of stories from around the world! There are other great sources, but Morgan's site offers the largest and most diverse collection of stories I have found.

Another tool Oguntala recommends for exploring the future are scenarios:

> Scenarios are stories about the future. They are rich and detailed stories of the future that are so vivid and distinct and thought through that you can start to see the good and the bad in them, the problems, the challenges, the opportunities that a certain future would present.
>
> —Angela Oguntala

Oguntala's over-arching message is the value of exploring the future through thinking in alternatives. This is also the practice of our comprehensivity, our inclination to understand Humanity's traditions of inquiry and action. Through exploring the future, through thinking in alternatives, through our comprehensivity, we may learn to act better in the world.

> Exploring possible futures [is] ...so we can act in the present. To find a way to make the present go in a new or a different direction. ...To think about what things could be different in the near and distant future and how could they be different.
>
> —Angela Oguntala

Angela Oguntala's TED Talk "Re-imagine the Future"

In Ogantala's TED talk, she ends with these words:

> Reconsider your vision of the future. Take a chance and be surprised.
>
> —Angela Oguntala

How should we explore the future?

Should we think in alternatives as Angela Oguntala recommends?

How can exploring possible futures help us see how we might better create a future that we would desire?

11.3 A Survey of Perspectives on Change

This resource is the third and final one in a brief series to survey a few of the traditions from Humanity's vast cultural heritage that touch on change in our lives. In the resource Rethinking Change and Evolution, we briefly examined Aborigine Dreamtime and the Pirahã culture, the provocative idea that "Genesis is ongoing" from the book The Design Way, Richard Lewontin's evolutionary thinking, and the hierarchy of change model from *The Design Way*[NS12]. The resource How to Create That-Which-Is-Not-Yet considered the possibility that through design and organizing our desiderata we can act to create the change that we desire. This resource explored anticipating and creating change through Angela Oguntala's thinking in alternatives approach to exploring futures.

There are many other traditions for thinking about change. Readers of Canto 7 in Dante's Inferno learn about his vision of the ministers of heaven Fortuna as a Catholic reimagining of the Roman goddess of fortune. The Mark Musa translation of the poem says, "Your knowledge has no influence on her; / for she foresees, she judges, and she rules / her kingdom as the other gods do theirs." This suggests that our only ability to design, create, or change our fortunes is through theology. Indeed this is one of the many possible ways to think about why our fortunes rise and fall.

Another approach to change can be found in the calculus as first developed by Leibniz and Newton in the 17th century. In particular, the branch of calculus called differential equations provides one of the most well-developed means of modelling change mathematically. Many of the epidemiological models for scenarioizing disease spread and vaccination impact are built on ideas from the calculus and differential equations, the mathematical sciences of change. Each of us have learned at least a little about these results of the calculus since COVID-19 started spreading exponentially around the world.

Another important approach to change is given by Buckminster Fuller who is quoted in Daniel Quinn's 1999 book *Beyond Civilization: Humanity's Next Great Adventure* [Qui99] as saying,

> ``You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.''

This is another expression of the idea that our primary role in Universe is to be creators and designers.

We learned from Angela Oguntala that the approach of thinking in alternatives by deeply understanding the stories and traditions of others may help us better understand and even create preferred futures. Thinking in alternatives is also the approach we have adopted for this short series of events exploring change. In fact, the approach can be applied in general to our comprehensivism, our practice of comprehending our worlds broadly and deeply. In general, thinking in alternatives provides a powerful method for exploring the often contradictory ways people have developed for thinking about many aspects of our complex world including futures and change.

What alternative traditions of inquiry and action should we consider to better understand and create change in our lives?

What are the traditions of inquiry and action that you use when trying to understand or create change?

What follow-on explorations of alternative traditions would you recommend for continuing our exploration of change?

This essay was written to provide ideas in support of the 12 May 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 1h 52m video from the 12 May 2021 event:

12 Redressing The Crises of Ignorance

03 June 2021 in Resource Center.

Buckminster Fuller discussed problems of ignorance in multiple contexts. His most dramatic usage was as a crisis of ignorance referring to our failure to recognize our abundance of solar, tidal, and geothermal energy causing the illusion of an "energy crisis". In this resource we abstract and interpret several crises of ignorance inspired, in part, by Bucky's thinking. We start by revisiting Bucky's idea of mistake mystique and Stuart Firestein's thinking on ignorance and science. Then we explore Bucky's essay "The Wellspring of Reality". Finally, we expand on some visionary ideas from Bucky's essay "Education Automation".

This exploration is organized around four critically important crises of ignorance and how we might redress them. This should reveal new ways to see the importance of our comprehensivity, our "wanting to understand all and put everything together" as Bucky explained it in his book "Operating Manual for Spaceship Earth".

12.1 The First Crisis of Ignorance: Mistake Mystique

In the resource Mistake Mystique in Learning and in Life, we learned from Bucky that all our lives begin in ignorance:

> By cosmic designing wisdom we are all born naked, helpless for months, and though superbly equipped cerebrally, utterly lacking in experience, ergo utterly ignorant.
>
> —Buckminster Fuller, in ``Mistake Mystique'' (1977)

Bucky goes on to emphasize that:

> [W]hatever humans have learned had to be learned as a consequence only of trial-and-error experience. Humans have learned only through mistakes.

—Buckminster Fuller, in ``Mistake Mystique'' (1977)

Bucky further explains in "Mistake Mystique" that all learning comes out of a navigational process of steering first too much to port (toward the left when looking toward the bow or front of a boat) followed by a course correction to starboard (toward the right). Through this process of ever more effective cybernetic steering (the regulation of systems organized around purposes), we can often reduce the gap between our errors and our objective like an expert steerswoman.

The key realization is that there is always a gap: whether between our knowledge and the full Truth (the truth gap), between our communications and what we mean (the ineffability gap), or between our actions and the outcome we intended (the design outcomes gap). Since none of us are gods, none of us is perfect and there is no way to eliminate these gaps. Diligently minding the gap so as to minimize it is our epistemic virtue of mistake mystique.

Cybernetics, which Bucky explained as "the Greek word for the steering of a boat" is the art of steering a purposeful system. He further explained that Norbert Weiner coined the term feedback to refer to the error-identifying control process. Mistake mystique is the practice of actively attending to the system feedbacks to manage the gap between our hypotheses and truth, between our communications and what we mean, between the results of our efforts and what we intend. Good navigators can minimize these gaps with incisive and frequent adjustments to stay on course. All purposeful systems require this kind of ongoing management. Our lives are purposeful systems. Mistake mystique is a crucial art for our cybernetics of living.

Is mistake mystique a crucial guide for our knowing, for our communications, for our actions, and, in general, for our governance?

Does the lack of awareness of the profound importance of mistake mystique constitute a crisis of ignorance?

12.2 The Second Crisis of Ignorance: the Hypostasis of Knowledge

In the resource on mistake mystique, we also examined Stuart Firestein's idea that what we don't know, our ignorance, is more important than our knowledge.

> Knowledge is a big subject. Ignorance is bigger. And it is more interesting.
>
> —Stuart Firestein, ``Ignorance: How It Drives Science'' (2012)

Firestein suggests that knowledge and ignorance co-define each other, like inside and outside. This is correct: assertions and hypotheses always come to life in a sea of questions and wondering. Marina Warner suggests that even fantasy, fairy tale, and myth are a kind of inquiry: they are hypotheses offered to help us wonder. All our assertions are, in fact, veiled questions; they are hypotheses. Properly understood, all our knowing is characterized by a structure of hypotheses standing in a field of ignorance. This is the underlying foundation, the hypostasis, of our knowing.

Peter Galison seems to corroborate this view:

> If you go back to one of the great Old English origins of the word ``understanding,'' under doesn't mean beneath, it actually meant ``among.'' ``Standing,'' was different forms of standing. It's almost like you're standing in a grove of different trees. That sense of being among these different ways of grasping the world---some predictive, some mathematical---... that ability to stand among these different things might be something that we want....
>
> —Peter Galison, in ``Epistemic Virtues'' (2019)

I think it amounts to this: understanding is about how our ignorance and our hypotheses stand among each other. The questions and the assertions are both crucial to organizing our understanding, steering our conversations, and guiding us in effective design. It is an inherently comprehensive view: how do all our questions and facts stand together?

Is the basis for knowledge necessarily organizing our experiences, our ignorance, and our multiple hypotheses into an integrated understanding?

When we fail to appreciate the importance of experience, ignorance, and hypotheses in forming our knowledge, is it a crisis of ignorance?

12.3 The Third Crisis of Ignorance: Generalized Principles

Buckminster Fuller provides another rationale and definition for our comprehensivity in his essay "The Wellspring of Reality":

> General systems science discloses the existence of minimum sets of variable factors that uniquely govern each and every system. Lack of knowledge concerning all the factors and the failure to include them in our integral imposes false conclusions. Let us not make the error of inadequacy in examining our most comprehensive inventory of experience and thoughts regarding the evoluting affairs of all humanity.
>
> —Buckminster Fuller, in ``The Wellspring of Reality'' (1975)

With this preface, Bucky defines science as "the attempt to set in order the facts of experience". Sometimes Bucky attributes this to Arthur Eddington; in "Wellspring" he attributes it to James Jeans. I suspect both attributions are spurious. I have been unable to find the origin of the quote. The sources I find in WikiQuote and in other searches trace back to Bucky. Perhaps, Bucky read these authors and imaginatively inferred the quote from his meditation on their accounts of science? I do not know. The definition may be Bucky's synthesis from many sources including Eddington and Jeans.

Bucky's definition of science as setting our experiences in order adds an empirical basis to the original meaning of science as "knowledge" (in Latin as scientia). A strength of Bucky's definition is its accommodation of not only the most hard-nosed materialist view, but also mystical, religious, and spiritual experience. In fact, we can now see how each of Humanity's traditions of inquiry and action can be seen as a "science" because each has its own way of putting in order the experiences it identifies and values.

Bucky highlights the important role of generalized principles for science:

> The word generalization in literature usually means covering too much territory too thinly to be persuasive, let alone convincing. In science, however, a generalization means a principle that has been found to hold true in every special case.... Mind is the weightless ... faculty that surveys the ever larger inventory of special-case experiences stored in the brain bank and, seeking to identify their intercomplementary significance, from time to time discovers one of the rare scientifically generalizable principles running consistently through all the relevant experience set.
>
> —Buckminster Fuller, in ``The Wellspring of Reality'' (1975)

Bucky thinks that the abstraction from special-case experience to generalized principle is the key idea. He is right: the value of all learning and all education is applicability beyond any particular special case experience, the ability to effectively address new situations.

However, later in the essay, when Bucky insists on calling the generalized principles eternal, he overlooks an important insight first identified by David Hume: there is no operation of reason nor of the mind which can guarantee that any hypothesized generalized principle, not even one which has applied in every special case through today, will also apply tomorrow. David Hume's famous example is the generalized principle that the Sun will appear in the Eastern sky tomorrow morning. Of course, Hume realizes the Sun will probably make its customary appearance, but there is no principle that can prove it.

Our realization that through all our experience a proposed property holds true, permits us to call our hypothesis a generalized principle. Even if an exception is found, we know that our proposition agrees with some subset of our experience data. But even the most learned comprehensivist does not have access to all human experiences: there will always be some traditions that we have not yet incorporated into our thinking. Some tradition somewhere might know how and why our generalized principle is limited in applicability or, perhaps, even wrong. So it behooves us to consider it merely an hypothesis.

Recent examples beg us to heed this important truth. The best science predicted that Hilary Clinton had a 71.4% chance of winning the 2016 US Presidential election. That tomorrow never came, instead the outcome with a 29.6% percent likelihood became certainty. More recently, the dawning realization that the hundred year old theory that infectious respiratory diseases spread by droplets is probably wrong. That mistake may have significantly exacerbated our response to the COVID-19 pandemic as Zeynep Tufekci notes. These kinds of failures are normal in science. Science frequently gets the facts wrong. Stuart Firestein writes in "Ignorance", "all scientists know that it is facts that are unreliable." We need to thoroughly understand the ignorance surrounding a fact to truly assess its trustworthiness.

There is another critical point to recognize about Bucky's notion of generalized principles: the vital importance of our comprehensivity. Recall that Bucky said, "mind ... surveys the ever larger inventory of special-case experiences ... [to discover] one of the rare scientifically generalizable principles". In order to identify generalized

principles, we benefit from having access to large collections of experience data. Our comprehensivity, our inclination to comprehend our worlds broadly and deeply, tunes us into Humanity's vast cultural heritage which gives us access to a significantly larger inventory of experiences than specialists or isolated enclaves might consider. This gives us many more opportunities to find generalized principles and their exceptions. These are similar to the advantages Angela Oguntala found for thinking in alternatives. Our comprehensivity permits us a broader and more incisive access to Humanity's inventories of experiences and generalized principles.

The main thesis of Bucky's "Wellspring" essay may be seen in this condensed quote:

> The wellspring of reality is the family of weightless generalized principles....[Which can] lead all humanity into omnisuccessful survival as well as entrance into an utterly new era of human experience in an as-yet and ever-will-be fundamentally mysterious Universe.
>
> —Buckminster Fuller, in ``The Wellspring of Reality'' (1975)

I interpret Bucky to mean that the inventory of all Humanity's identified generalized principles provides us our clearest possible sense of the source, the wellspring, of reality. Bucky acknowledges that this highly informed perspective will still be fundamentally mysterious: our ignorance will always encompass our facts as Stuart Firestein also emphasizes.

In addition, Bucky is saying that only through the generalized principles can we come to "omnisuccessful survival". I think this is because in our cybernetic steering to omnisuccess ("omni" means all, so "omnisuccess" means success for everyone) the availability of a large inventory of proven generalized principles helps us minimize the mistakes we make. That is to say, the generalized principles are useful because they empower our mistake mystique.

There is a threat to the great potential that the generalized principles offer to Humanity. Bucky explains,

> Unguided by science, society is allowed to go right on filling its childrens' brain banks with large inventories of competence-devastating misinformation. In order to emerge from its massive ignorance, society will probably have to rely exclusively upon its individuals' own minds to survey the pertinent experimental data---as do all great scientist-artists.

—Buckminster Fuller, in ``The Wellspring of Reality'' (1975)

This reminds me of the earlier part of his essay that warns about overspecialization, our failure to attend to comprehensiveness. This is our failure to cultivate our comprehensivity. Bucky seems to think it is causing us to overlook our options for omnisuccess.

The crisis of ignorance which Bucky seems to be warning us about is our failure to integratively accommodate Humanity's already vast inventory of experiences with our treasure trove of generalized principles from all our great traditions of inquiry and action. I think Bucky is suggesting that each of us ought to more conscientiously practice our comprehensivity by surveying the enormous inventory of available experience data and the vast collection of hypothesized generalized principles to separate the misinformation from the more reliable generalized principles so we might better improve our options for omnisuccess.

Is our failure to conscientiously and comprehensively review Humanity's vast inventories of experiences to distill out the most effective generalized principles for our omnisuccess, a crisis of ignorance?

When we fail to realize the importance of our comprehensivity in assessing our inventory of generalized principles so we might better contribute to Humanity's omnisuccess, is it a crisis of ignorance?

12.4 The Fourth Crisis of Ignorance: Education Automation

In Buckminster Fuller's 1962 essay "Education Automation", he imagined how "two-way TV" might revolutionize education by "Freeing the scholar to return to his studies" as the subtitle of the essay puts it. Here is one of his most prescient futures from that essay:

> I am quite sure that we are going to get research and development laboratories of education where the faculty will become producers of extraordinary moving-picture documentaries. That is going to be the big, new educational trend.
>
> —Buckminster Fuller, in ``Education Automation'' (1962)

By 2012 Coursera, quickly followed by EdX, FutureLearn, and many others, started offering massive open on-line courses (MOOCs) with multiway-Internet, instead of Bucky's two-way TV, and with spaces for interactivity and other feedbacks for learning. As a result, Bucky's once visionary idea has become a bit quaint.

I have taken more than 100 courses from MOOCs or their less structured antecedents in the open educational resources movement. These courses provide access to many of our most prominent traditions of inquiry and action. As such they provide a treasure trove of resources to help us develop our comprehensivity. However, too many of these resources include the taint of arrogance in seeing their particular tradition as superior to others. This can discourage our comprehensivity, our inclination to understand our worlds in a way that is "macro-comprehensive and micro-incisive" as Bucky put it in "Operating Manual for Spaceship Earth". How can we do better?

Recall that in "Wellspring", Bucky said, "society will probably have to rely exclusively upon its individuals' own minds". By the late 1940s, Bucky included students in his exploratory projects. Daniel López-Pérez, author of the 2020 book "R. Buckminster Fuller: Pattern-Thinking", suggested that Bucky's process of incorporating students in his exploratory research may have emerged from the long established design studio tradition in architecture and design schools. The addition of new ideas, new questions, and new perspectives from his students' own individual minds may have empowered Bucky's breakthroughs in prototyping the geodesic dome and tensegrity structures. For example, it was Bucky's student Kenneth Snelson who first demonstrated Bucky's principle of continuous tension and discontinuous compression in a physical model. So collaborative engagement with many unique minds might be the crucial tool for effective development and research activities.

> As we now disemploy [people] as muscle and reflex machines, the one area where employment is gaining abnormally fast is the research and development area. Research and development are a part of the educational process itself. We are going to have to invest in our people and make available to them participation in the great educational process of research and development in order to learn more. When we learn more, we are able to do more with our given opportunities.
>
> —Buckminster Fuller, in ``Education Automation'' (1962)

These thoughts lead us, perhaps, to identify our most consequential crisis of ignorance: how ought we go about automating our educational systems so that everyone can, on an ongoing basis, acquire knowledge of the various traditions of inquiry and action in support of their individually articulated but collaboratively coordinated efforts to design a more desirable future? This is my abstraction and reformulation of Bucky's vision for education automation. It is my attempt to address Bucky's 1972 New York Times call for "Education Revolution: The Highest Priority of All".

Is our failure to fully engage all the citizens of Earth in an ongoing lifelong educational process to apply all our diverse minds to distill and apply the learning from all Humanity's traditions of inquiry and action in support of collaborative development and research initiatives for civilization's omnisuccess, a crisis of ignorance?

When we fail to organize effective ongoing full-lifetime educational systems to foster comprehensive thinking and the regenerative design of the world for omnisuccess, is it a crisis of ignorance?

12.5 The Importance of Our Comprehensivity

In each of the four crises of ignorance above, our comprehensivity, our inclination to understand our worlds ever more extensively and ever more intensively, is an important means to redress the crisis. Observe:

1. Our comprehensivity can inform our mistake mystique as it strives to identify, anticipate, and minimize "the gap" in our cybernetic steering,
2. Our comprehensivity can make us aware of multiple hypotheses and alternative lines of inquiry to better see how our ignorance and hypotheses stand together in forming our knowledge,
3. Our comprehensivity can help us find more generalized principles and their exceptions to better understand the wellspring of reality, and
4. Our collaborative comprehensivity may be the guiding practice to best support our revolution for education automation.

It seems to me that only through the breadth, depth, and creative integration of our comprehensivity can we hope to redress these crises of ignorance. Fostering our comprehensivity may be the imperative for our times.

This essay was written to provide ideas in support of the 9 June 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas(crossposted at The Greater Philadelphia Thinking Society).

Addendum: 2h 42m video from the 9 June 2021 event:

13 Comprehensivism in the Islamic Golden Age

08 July 2021 in Resource Center.

Comprehensivism is the practice of integrating as many of Humanity's sources of learning as possible to better comprehend the world and how it works. The Islamic Golden Age, roughly between the 8th and 14th centuries CE, forged a culture infused with comprehensivist epistemic virtues and these significantly shaped what historian Richard Bulliet calls *Islamo-Christian Civilization* and the development of Renaissance comprehensivists like Leonardo and modern science.

How did the Islamic world establish their comprehensivist foundation for knowledge? In this resource we will explore some of what has been learned of the cultural traditions that came together during the Islamic Golden Age to provide a historical background for today's comprehensivism movement. We will offer a comprehensivist interpretation of three exquisite hour long BBC documentaries on "Science and Islam" with the award-winning physicist Jim Al-Khalili as host:

1. "The Language of Science": http://y2u.be/stJOl0PYHUE
2. "The Empire of Reason": http://y2u.be/z-xQKfMWK2Y
3. "The Power of Doubt": http://y2u.be/SwHvQiihXg4

We will also consider Patricia Fara's epic 2009 book "Science: A Four Thousand Year History", Dimitri Gutas's 1998 book "Greek Thought, Arabic Culture: The Graeco-Arabic Translation Movement in Baghdad and Early □Abbāsid Society", and other resources.

13.1 The Origins of Islamic Comprehensivism in The Translation Movement

Comprehensivism is a newly coined term based on Buckminster Fuller's writing and speaking about "comprehensivity" in the 1960s. We have abstracted his idea into *comprehensivism*, the practice of understanding the world and its peoples through both extensive and intensive explorations with the aim of forming a more and more complete and integrated comprehension of our worlds.

Comprehensivism encompasses at least six epistemic virtues, six values for good learning (for more information on this theory of learning, examine these resources:

- The Value of Multiple Working Hypotheses
- The Inductive Attitude: A Moral Basis for Science and Comprehensivism
- Mistake Mystique in Learning and in Life
- Redressing The Crises of Ignorance

):

1. Learning that aspires to broadly engage the knowing of other traditions of inquiry and action (*breadth*)
2. Learning that aspires to thoroughly comprehend each topic of interest (*depth*)
3. Learning that aspires to circumscribe the whole of Human knowing, the whole world and all its peoples (*wholeness*)
4. Learning that aspires to both infer its hypotheses and to assess them from the evidence in all Humanity's experience (*empiricism*)
5. Learning that aspires to organize a complex of multiple working hypotheses structured by a fabric of discriminating questions to form a highly refined system of interpreted exemplars and principles (*refined ignorance*)
6. Learning that recognizes the inherent gaps that exist in all finite human knowing and aspires to further minimize these gaps in our understandings (*mistake mystique*)

The Islamic world may have valued the first four of these epistemic virtues and may have formed a rudimentary appreciation for all six, but I do not know enough to be sure. Our objective here is to scope the Islamic precursor to comprehensivism.

Consider this list of great and acknowledged polymaths who lived in the Islamic Empire during its golden age and who we might see as practitioners of an incipient comprehensivism:

1. Theophilus of Edessa (Christian, 695–785)
2. Abū Mūsā Jābir ibn □ayyān (c. 721–c. 816)
3. al-Jā□i□ (776–c. 869)
4. Mu□ammad ibn Mūsā al-Khwārizmī (c. 780–c. 850)
5. Ziryab (c. 789–c. 857)
6. Al-Kindī (c. 801–873)
7. Hunayn Ibn Ishaq (809–873)
8. Ibn Qutaybah (c. 828–889)
9. Abū Bakr Muhammad Zakariyyā Rāzī (854–925)
10. Ibn Wa□shiyyah (d. c. 930)
11. Al-Farabi (c. 872–c. 950)
12. Al-Zahrawi (936–1013)
13. Ibn al-Haytham (c. 965–c. 1040)
14. Al-Biruni (973–c. 1050)
15. Ibn Hazm (994–1064)
16. Ibn Sīnā (c. 980–1037)
17. Omar Khayyám (1048–1131)
18. Al Ghazali (c. 1058–1111)

19. Ibn Rushd (1126–1198)
20. Maimonides (Jewish, 1135–1138)
21. Ismail al-Jazari (1136–1206)
22. Nasir al-Din al-Tusi (1201–1274)
23. Ibn al-Nafis (1213–1288)
24. Ibn al-Shatir (1304–1375)
25. Ibn Khaldun (1332–1406)
26. Matrakçı Nasuh (1480–c. 1564), and many others.

What was the historical context that fostered the development of so many comprehensivist explorers during the Islamic Golden Age?

> The Islamic conquests began in 622 and by 750 encompassed the African regions once controlled by the Roman empire and most of Iberia (Spain and Portugal), all of the Levant, much of Eastern Turkey and the Caucasus (the region between the Black and Caspian seas) continuing through Iran, Afghanistan, and much of Pakistan. In 750 a civil war changed the ruling elites from the Umayyads to the Abbāsids who in 762 created the city of Baghdad as its capital.
>
> Like most successful emperors from Caesar to Napoleon, [the Islamic rulers known as Caliphs] understood that political power and scientific know-how go hand in hand. There were many reasons for this. Some were practical: medical knowledge could save lives, military technology could win wars, mathematics could help deal with the increasing complexities of the finances of state, and Islam as a religion also played a pivotal role. The Prophet himself had told believers to seek knowledge wherever they could find it even if they had to go as far as China. And many Muslims, I'm sure, felt that to study and better understand God's creation was in itself a religious duty.
>
> —Jim Al-Khalili, ``The Language of Science'' Episode 1 in ``Science and Islam'' (2009)

> That is, the cultural values for learning ran deep in Islamic society from its foundation. In addition, we know that for the first few centuries of Islamic rule, most citizens were not Muslims, they were pagan, Jewish, Christian, Zoroastrian, etc., and had their own traditional languages, so the Islamic rulers needed a way to manage the affairs of state across a huge empire where historically business and government were conducted in many local languages. Starting in 697, Caliph Abd al-Malik started establishing Arabic as the administrative language of the state.
>
> By the early 800s the ruling elite of the Islamic Empire were pouring money into a truly ambitious project which was global in scale and which was to have a profound impact on science. It was to scour the libraries of the world for scientific and philosophical manuscripts in any language, Greek, Syriac, Persian, and Sanskrit, bring them to the Empire and translate them into Arabic. This became known as the translation movement.
>
> —Jim Al-Khalili, ``The Language of Science'' Episode 1 in ``Science and Islam'' (2009)

According to Dimitri Gutas,

> ``The translation movement, which began with the accession of the Abbāsids to power and took place primarily in Baghdad, represents an astounding achievement which ...can hardly be grasped and accounted for otherwise than as a social phenomenon ...[it] lasted, first of all, well over two centuries ...Second, it was supported by the entire elite of Abbāsid society: caliphs and princes, civil servants and military leaders, merchants and bankers, and scholars and scientists...Finally, it was eventually conducted with rigorous scholarly methodology and strict philological exactitude''
>
> —Dimitri Gutas, The Graeco-Arabic Translation Movement in Baghdad and Early Abbāsid Society, 1998, p. 2

The translation movement had precedents. There were many multilingual scholars pursuing various traditions of inquiry and action including theology, astrology, mathematics, alchemy, medicine, hermeticism, and other sciences. The Islamic innovation was to actively translate these other traditions into Arabic and create a common language for science and scholarship as Al-Khalili reports:

> Scholars from different lands who previously had no way of communicating, now, had a common language. And it was a language that was specially developed to be precise and unambiguous which made it ideal for scientific and technical terms.
>
> —Jim Al-Khalili, ``The Language of Science'' Episode 1 in ``Science and Islam'' (2009)

Al-Khalili is exaggerating there: scholars could travel and there is evidence of a correspondence tradition. But his point is valid: Arabic would become not just the language of the Prophet, but also the language for business, government, and scholarship throughout a huge geographical area. By translating works from many cultures into Arabic and storing them in Baghdad and other centers of learning, the translation movement embraced a comprehensive approach to learning.

Dimiti Gutas identifies a source for this Abbāsid interest in knowledge from all over: there was a view "widespread in the first Abbāsid century [in] the belief that Zoroaster himself was the author of all existing sciences and that he wrote them in all the languages of the world." Zoroaster was the founding prophet of Zoroastrianism which was the state religion in Persia (Iran) for more than 1200 years. The Sasanian empire ruled Persia from 224 until the Arab conquest of 651. They actively translated knowledge from around the world to collect the dispersed knowledge of Zoraster. This value was incorporated into the translation movement.

Patricia Fara further explains,

> ``Schools were closely attached to mosques and concentrated on revealed subjects. Gradually two new types of institution emerged—observatories and hospitals—which were also associated with mosques, but included a wider range of subjects in the syllabus. They included large libraries, because Islamic teachers placed great emphasis on studying texts, especially after a new cheap material was introduced—paper, which soon supplanted papyrus and vellum. Bringing together old knowledge with new discoveries, these educational centres were spread throughout the Islamic empire and stimulated research into the natural world.''
>
> —Patricia Fara, ``Science: A Four Thousand Year History'' (2009), p. 58

The Translation Movement and the culture of comprehensivist exploration it fostered probably influenced the first universities of Europe starting in the eleventh century and the Latin translations of the 12th century which led to the kind of comprehensive learning of Gerard of Cremona (c. 1114–1187), Roger Bacon (c. 1219/20–1292), Albertus Magnus (c. 1200–1280), and which is on display in Dante's epic poem, the Comedìa (1320).

Dimiri Gutas puts the translation movement in its historical context:

> [T]he Graeco-Arabic translation movement of Baghdad constitutes a truly epoch-making stage, by any standard, in the course of human history. It is equal in significance to, and belongs to the same narrative as, I would claim, that of Pericles' Athens, the Italian Renaissance, or the scientific revolution of the sixteenth and seventeenth centuries, and it deserves so to be recognized and embedded in our historical consciousness.
>
> —Dimitri Gutas, The Graeco-Arabic Translation Movement in Baghdad and Early Abbāsid Society, 1998, p.8

Did the translation movement constitute a form of comprehensivism?

How many of the six epistemic virtues of comprehensivism did Islamic society come to value?

13.2 Science in the Islamic Golden Age

If we interpret science broadly as all that is known (which matches the meaning of its Latin root scientia), we discover that the Islamic Golden Age was a heyday for science. One of the Islamic world's greatest scientists was Abu 'Alī al-Husayn ibn Sīnā (c. 980–1037, his name is frequently Latinized as Avicenna) who published The Book of Healing in 1027.

> [O]ne of the greatest Arabic treatises is called The Book of Healing...it aims to cure the reader's disease of ignorance.... [I]t sums up and organizes all the knowledge that a wise person needs to seek spiritual fulfilment...[It] was compiled in the early eleventh century and belongs to an important tradition of classifying knowledge in massive encyclopaedias. Rather than being an

Figure 13.1: Abu ʻAlī al-Husayn ibn Sīnā (c. 980–1037)

> arid scientific text, The Book of Healing is a poetic philosophical meditation that aims for comprehensiveness---it includes not only detailed explanations of Islamic Aristotelianism, but also an elaborate cosmology of angelic intelligences.
>
> —Patricia Fara, ``Science: A Fourt Thousand Year History'' (2009), pp. 56--7

This is strong support for our idea that comprehensivism was a value of the Islamic scientific community. Fara gives more evidence, “Ibn Sīnā’s writing was valued by his contemporaries not for its novelty but for its thoroughness and systematic organization.” We now have some of the backstory for those who wondered about the name Avicenna in Canto IV of Dante’s Inferno and the influences of the Christian theologian Thomas Acquinas.

Wikipedia shows how Ibn Sīnā’s work contributed to the approach of modern science including the practice of experimentation:

> In the ``Al-Burhan'' (`On Demonstration') section of [The Book of Healing], [Ibn Sīnā] discusses the philosophy of science and describes an early scientific method of inquiry. He discusses Aristotle's Posterior Analytics and significantly diverges from it on several points. [Ibn Sīnā] explains the issue of a proper methodology for scientific inquiry and the question of ``How does one acquire the first principles of a science?'' He asks how a scientist would arrive at ``the initial axioms or hypotheses of a deductive science without inferring

> them from some more basic premises?'' He explains that the ideal situation is when one grasps that a ``relation holds between the terms, which would allow for absolute, universal certainty.'' [Ibn Sīnā] then adds two further methods for arriving at the first principles: the ancient Aristotelian method of induction ..., and the method of examination and experimentation (tajriba). [Ibn Sīnā] criticizes Aristotelian induction, arguing that ``it does not lead to the absolute, universal, and certain premises that it purports to provide.'' In its place, he develops a ``method of experimentation as a means for scientific inquiry.''
>
> —Wikipedia article on The Book of Healing, accessed 4 July 2021

While Ibn Sīnā wrote about the philosophy of science, his contemporary the path-breaking Islamic scientist Abū Alī al-asan ibn al-asan ibn al-Haytham (c.965–c.1040, his name is frequently Latinized as Alhazen) practiced and demonstrated a new way of doing scientific research.

> [Ibn al-Haytham] led this movement to turn mathematics from a language of abstract forms into a truly practical science.... What al-Haytham and his contemporaries argued for was the possibility ...of a single science which would be both mathematical and philosophical which would link together a physics, a science of change, with a mathematics, a science of quantity.
>
> —Jim Al-Khalili, ``The Empire of Reason'' Episode 2 in ``Science and Islam'' (2009)

Between 1011 and 1021, Ibn al-Haytham published "Kitāb al-Manāir" or the Book of Optics. This revolutionary text aspired to replace a millennium of received wisdom on the nature of light and vision which Aristotle, Euclid, and the common sense of the times accepted. Al-Haytham needed an extraordinary method to penetrate the truths of these misconceived phenomena and to then convince himself and others that his new ideas were sound.

Al-Haytham's solution was to significantly expand upon the practice of systematically testing both his assumptions and his hypotheses. In addition, he explained his incisively discriminating experiments so meticulously that others could easily replicate them. The systematic testing of assumptions and hypotheses and the repeatability of experiments are vitally important epistemic virtues for modern science.

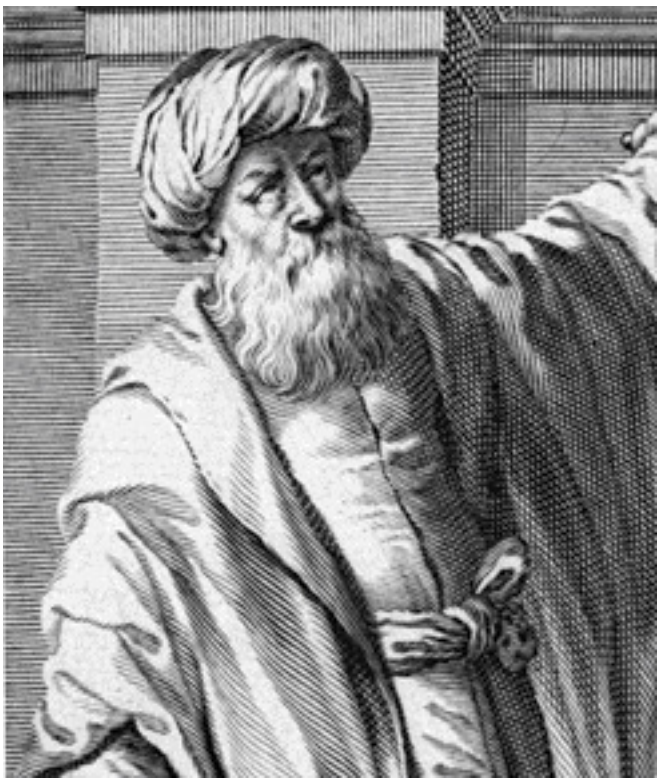


Figure 13.2: Abū Alī al-asan ibn al-asan ibn al-Haytham (c.965-c.1040)

Ibn al-Haytham did not proscribe his new methods, instead he merely used them to prove new principles in optics that were contrary to the received wisdom of his time. This history decisively proves as false the Eurocentric claims that Roger Bacon (c. 1220–c. 1292), or more commonly, Francis Bacon (1561–1626) developed the methods of systematic testing and repeatability of experiments. They both popularized ideas that Ibn al-Haytham used in his practice of science. Francis Bacon's influential *Novum Organum* of 1620 should be heralded not as the father of modern science but as popularizing important epistemic virtues of science that Islamic scientists had developed some 600 years earlier during the Islamic Golden Age.

Ibn al-Haytham was also responsible for initiating the line of research that led to the new model of our solar system developed by Copernicus, Kepler, Galileo, and Newton. In the early 1000s, Ibn al-Haytham wrote the path-breaking work "Al-Shukūk ʿalā Batlamyūs" (Doubts on Ptolemy). He argued for the epistemic virtue that data and theory should agree. He pointed out that Ptolemy's model of the solar system did not, in fact, put the Earth at the center, it wasn't really geocentric, and it wasn't matching recent observations.

Islamic astronomers worked diligently to fix the issues that Ibn al-Haytham pointed out with Ptolemy's model. By the time of Copernicus, one group had succeeded but at the price of even more complexity. Copernicus' heliocentric hypothesis was developed with awareness of many of these Islamic explorations into the mechanics of the solar system. Copernicus' contribution was important for later European developments, but it stood on the shoulders of Islamic science. A fact that, since the Enlightenment, has frequently been omitted from our histories.

The foundational epistemic virtues of comprehensivism are breadth and depth. Ibn Sīnā's encyclopedic The Book of Healing exemplifies the breadth of Islamic science. Ibn al-Haytham's meticulous study of optics and the centuries long research project he initiated to resolve some doubts about Ptolemy exemplifies the depth of Islamic science.

Were at least some of the epistemic virtues of comprehensivism in evidence in the science of the Islamic Golden Age?

Is the Islamic Golden Age the most prominent historical example of a culture infused with the values of comprehensivism?

13.3 The Historical Roots of Comprehensivism

Was there comprehensivism before the Islamic Golden Age? What was the early history of comprehensivism?

If we interpret science broadly to mean all knowing, then comprehensivism is another approach to science. So we can look to the history of science for the roots of comprehensivism. In Patricia Fara's 2009 book "Science: A Four Thousand Year History", she finds traces of the history of science in the Rig Veda, the Bible, and in early writings from Mesopotamia. She also cites the pre-historical astronomical evidence of Stonehenge and ancient Latin American structures that are also attuned to the stars. We know that science predates history and Fara starts her story at the ethereal boundary between pre-history and the first preserved writing on science.

This way of thinking leads us to realize that comprehensivism is not an idea forged by me nor by Buckminster Fuller, Ibn Sīnā, Aristotle, or even Zoroaster. Comprehensivism is an age-old approach to learning and knowing. How old will require someone with more historical perspicacity than me to determine. But it is at least as old as the Islamic Golden Age. It may be as old as Aristotle. It may be much, much older than that. Consider this: if the principle of gravity broadly applies to every mass in the Universe with a deep, precise inverse second power mathematical relationship, perhaps the values of breadth and depth in comprehensivism explain the way every particle of mass learns about its world. Then comprehensivism might be as old as the Universe itself.

This essay was written to provide ideas in support of the 14 July 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 2h 12m video from the 14 July 2021 event:

14 Shifting Perspectives and Representing The Truth

15 August 2021 in Resource Center.

In an exquisite video presentation Tricia Wang explains the benefits of perspective shifting to better represent the truths of our worlds and its peoples:

This resource will situate Wang's powerful and important ideas in the context of our *Art of Comprehensivity*, our learning practices for building an ever more extensive, ever more intensive, and ever more integrated understanding of our worlds and its peoples.

14.1 Representing the Truth

Tricia Wang begins her presentation exploring the technology of linear perspective which was rediscovered and then flourished in fifteenth century Renaissance Europe. Wang explains how the hype-man of the European perspective movement, Leon Battista Alberti, presented this new technology of optical illusion:

> Alberti believed that linear perspective was the highest form of art because he believed it captured reality. He said, ``A painting aims to represent things seen''. Alberti thought that painters using linear perspective were giving society a shortcut to greater understanding making us better people.
>
> —Tricia Wang 16 August 2016 Presentation at The Conference

In fact, linear perspective is an illusion. Such representations are not the objects depicted and the optics of our eyes differ substantially from the optics of linear perspective. For instance, our binocular eyes have concave retinas affecting the inverted images our optic nerves "see", our sharp fovea centralis only sees details clearly in a

tiny region near the center of our field of view, the body and its eyes constantly move while the vanishing points in artworks are fixed. Moreover, perspective representations privilege one view to the exclusion of all the other possible optical views and any nonoptical models that one might otherwise use to represent the truths of a situation.

Wang tells the story of a group of Jesuit monks who starting in the sixteenth century tried to proselytize their religion by impressing the Ming dynasty Chinese with linear perspective paintings. She emphasizes how the truth of linear perspective collided with Chinese sentiments and failed to gain traction. This Chinese view was partially captured by an earlier Tang dynasty writer:

> He who judges painting according to the concept of resemblance shows the understanding of a child.
>
> —Sou Che (9th century) as quoted in ``Oblique Drawing: A History of Anti-Perspective'' (2012), page 348

Wang discusses the distortions in maps. Maps are another technology to represent the world. But as Wang emphasizes, the creators of paintings, maps, films, and data sets, have many choices to make in representing their subjects. Wang shows a slide that says, "By necessity, technology reduces resolution in order to render reality. The creator's choices guide what gets lost in computation."

Wang also observes that mirrors can be used as a technology for the representation of truth. Although mirrors probably existed long before the first polished obsidian that archeology dates to some 8,000 years ago in Anatolia (now called Turkey), eventually, Wang reports, "people interpreted this 'realness' of the reflection from a glass mirror as truth." She adds, "Glass mirrors showed up in Shakespeare's plays as this object of truth."

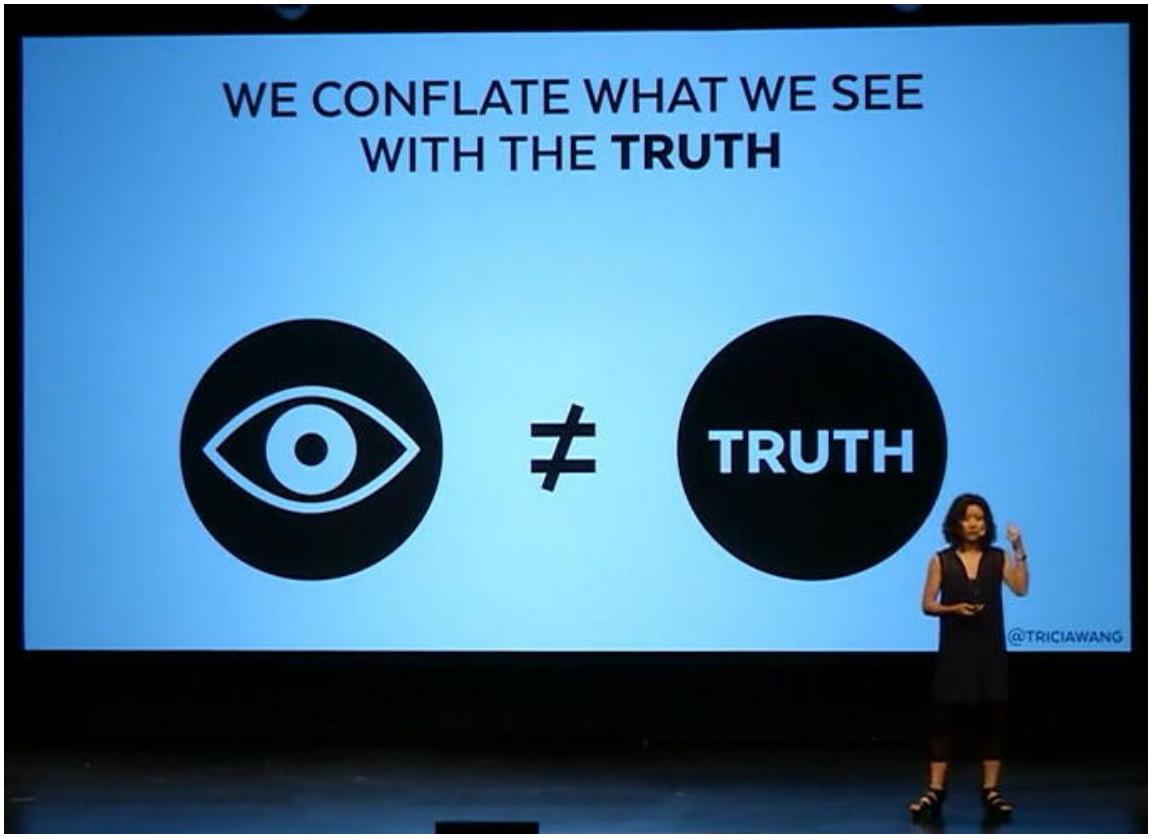
Wang builds to a broader thesis that truth came to be defined as "a singular, stable, objective thing." She infers that "we conflate what we can see with the truth" even though we know that mirrors distort left-right sense and the optics of mirrors can be engineered to produce many surprising illusions. They merely present a distorted but insightful view of an always multifaceted truth.

Virtual reality (VR) is another technology that some proponents claim gives the viewer a higher fidelity access to the truth, but Wang demonstrates that despite the hype, 360° immersion is a curated experience created by a designer, filmmaker, or curator. She illustrates her point by examining the qualitatively different user experi-

ences in two VR films: “6×9” and “CONFINEMENT”. Francesca Panetta, the director for “6×9”, consulted prisoners who had lived in solitary confinement and by listening carefully to these real survivors, she created a more realistic and compelling VR film. The quality of the curation affects the interpretation of any representation even with virtual reality.

Photography is another technology whose seeming realism has blinded people to its illusions, distortions, and biases. She quotes the filmmaker Jean Luc Goddard: “Photography is truth.” To illustrate how insidious the biases in photography can be Wang reports on the widely read and esteemed National Geographic Magazine with its famous photography. But their photos are frequently staged and in 2018 the current editor, Susan Goldberg, admitted that past content was racist, in some cases disturbingly racist. Photography is not innocent and truthful, but reflects the biases of photographers, curators, and editors.

Although Wang only briefly mentions it, big data is another mesmerizing technology which carries powerful but illusory intonations that it reveals the truth. Another example of technology with often illusory effects is mentioned in the 1981 book “Critical Path” where Buckminster Fuller wrote, “Words are tools”. So, by Wang’s logic, language also suffers from the inherent limitations of any technological representation.



While each technology is valuable in that it can reveal new aspects of the truth, Wang emphasizes throughout that technological representations are frequently and erroneously abstracted to be the truth. She cautions us, "We still have the myth that we can see reality from a single perspective. And that that single perspective is the objective truth." When, in fact, we actually have what Wang calls the limits of a single perspective.

Can any single technology ever represent more than a narrow, distorted glimpse of the truth? Are all representations necessarily low fidelity?

14.2 Perspective Shifting

In the stories Tricia Wang develops in her presentation, she emphasizes how the truth of one representation by a technology can collide with the values of other people. The Ming era Chinese didn't value the seemingly realistic illusions in the art of linear perspective. The mapmaker, photographer, journalist, writer, editor, and VR film

producer cannot give the armchair traveler a high fidelity experience of actually engaging with a far off place and its peoples. The vicarious experience is not the real experience; the gamer and the couch potato watching representations on a screen are not experiencing our real world.

Technology-enhanced representations can inform our understanding of the world, but they are always incomplete and their view of reality is always distorted. This inherent narrowness of our representations can collide with the values and understandings of other people which in turn can cause friction and conflict.

Wang defines "perspective collision" as "when the outputs of technology or the things we make end up revealing the limited perspective of their creators". How can we avoid such perspective collisions?

Wang recommends developing the skill of "perspective shifting" which she defines as "the ability to see the world from another person's point of view. Essentially, it's empathy." She further explains:

> Understanding the world is not about replicating one perspective. It's about representing multiple perspectives. This is the work ...[of] perspective shifting.... Everyone needs to learn how to perspective shift. This involves skills like listening to understand instead of just asking questions about what we already know. To see greater context beyond the technology instead of just focusing on the interaction. To identify things that are very difficult to measure not just making decisions off of data sets that we already have. It's also about asking who else do we need to invite to the table instead of just working with the default majority.
>
> —Tricia Wang 16 August 2016 Presentation at The Conference

Is perspective shifting a vital skill for working with technology, representations, and truth?

14.3 The Truth and our Comprehensivity

In the exchange after her presentation, Wang explains that seeking the truth is a terrible goal. I believe she means that seeking the truth predisposes us to converge on a single representation of our subject or situation which then blocks us from apprehending its full multiperspectival context. Wang suggests that perspective shifting should replace our search for truth as the objective for understanding.

I agree with her, but I would go further. I would place perspective shifts in the broader context of understanding as a *thoroughly refined ignorance*. This is one of the guiding values we have been developing for our comprehensive learning. In comprehensive learning we aspire to integrate many perspectives, to use Wang's language. One way to think about our refined ignorance would be to identify each aspect of each perspective with the series of yes-no questions that locates it as in the game Twenty Questions. Then we can imagine other games of Twenty Questions that distinguish each perspective from the others. Finally, more such games could distinguish the different ways to integrate all of the identified perspectives into a synergetic whole. In this way our ignorance can be seen as the fabric of questions that structures our comprehensive learning.

Our *thoroughly refined ignorance* is based on ignorance because questions guide all inquiry and all principles can be seen as the answers to contextualized questions. It is refined because nuanced questions can distinguish different perspectives, hypotheses, and interpretations. It is thorough because our steadfast comprehensivity aspires to a comprehensive understanding of the world and its peoples. Tricia Wang's idea of shifting perspective is an important tool in helping us to more thoroughly refine our ignorance.

In the resource on The Value of Multiple Working Hypotheses we examined the epistemic virtue of T. C. Chamberlin's great contribution to the moral reform of science with the discriminating edges of multiple working hypotheses. How does Wang's method of perspective shifting compare with Chamberlin's?

I think the difference is a matter of language. A hypothesis in science assumes all the experiences and refined ignorance that went into formulating it and supporting its plausibility. All this context is, in fact, a perspective: the perspective that sees the hypothesis as reasonable. So, a perspective shift can be seen as essentially the same as considering another possible working hypothesis together with its context.

Multiple working hypotheses and perspective shifts provide the same benefit to the Explorer in Universe: to form a more *thoroughly refined ignorance*. Both Wang's perspective shifts and Chamberlin's multiple working hypotheses remind us that comprehensive thinking is broader than any one perspective or any one hypothesis. Wang's perspective shifts are more suggestive of the language of the humanities and social sciences in highlighting context whereas Chamberlin's multiple working hypotheses suggest the language of scientific discourse.

Now, perhaps, we are in a position to see the wisdom in Tricia Wang's astonishing sound bite "Don't Trust The Truth". Truth can be seen as the coherence of a perspective or hypothesis with the experiences and beliefs that justify it. That is, every truth has a perspective. Such a perspective has limitations: it is informed by limited experience, limited assumptions, and limits of the methodology organizing its beliefs. Perspective shifting is the process of considering other contexts and points-of-view. Since life is finite, we cannot consider all possible points-of-view, all possible assumptions, all possible hypotheses, everyone's full set of experiences, and all possible contexts. So our truths are always limited and incomplete.

In the end we see that perspective shifting, multiple working hypotheses, and engaging multiple approaches (or traditions) of inquiry and action can help us form a more *thoroughly refined ignorance*. This ignorance, then, is the broadest comprehensive comprehension and is the best representation of Truth we can acquire at any time. Our thoroughly refined ignorance as a truth may be one of our best tools for assessing our desires to effectively organize a design to better shape our futures. But at every moment it is incomplete and therefore never truly trustworthy. So Tricia Wang is profoundly correct when she warns us "Don't Trust The Truth"!

How do you see the Truth in our art of comprehensivity, our art of learning ever more extensively, ever more intensively, and ever more integratedly? How trustworthy is it?

This essay was written to provide ideas in support of the 18 August 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 1h 58m video from the 18 August 2021 event:

15 The Whole Shebang: “to understand all and put everything together”

07 September 2021 in Resource Center.

The featured quote in the title comes from Buckminster Fuller’s 1969 book “Operating Manual for Spaceship Earth”. When we previously explored this book in the resource The Comprehensive Thinking of R. Buckminster Fuller, we described this quote as “the creed of the comprehensivist”. This resource will interpret the quote to identify issues of wholeness in comprehensive inquiry and action.

To gain insights into the wholeness implicit in our highlighted quote, we will consider three additional resources: Buckminster Fuller’s “Synergetics”, Jan Zwicky’s summary of the gestalt theory of learning in “The Experience of Meaning”, and “The Design Way” by Harold G. Nelson and Erik Stolterman which has an extensive chapter on “The Whole”. This will give us an adequate first-cut attempt at indicating the nature and importance of wholeness in comprehensive exploration.

15.1 Starting with Universe

“Bucky” is a moniker for Buckminster Fuller. His full quote excerpted in our title is “Nothing seems to be more prominent about human life than its wanting to understand all and put everything together”. The quote highlights important values for our comprehensivity, our inclination for comprehensive inquiry and action to better understand and participate in the world.

“To understand all” gestures toward a broad understanding of the whole world, of the Universe. In the resource on Bucky’s comprehensive thinking, we learned that he defined Universe as “all of humanity’s consciously-apprehended and communicated experience”. We may interpret this to include our entire cultural heritage since all the experience available to us comes from our cultural inventory of artifacts, stories, and bundles of experiences. This heritage therefore embodies all our possible sources for our learning and each thread from this great amalgamation of experiences, of the Universe, might be distinguished as one of humanity’s traditions of inquiry and action.

In Bucky’s 1975 magnum opus “Synergetics” he suggests that all inquiry should begin with Universe:

> Problem solving starts with Universe and thereafter subdivides by progressively discarding irrelevancies thereby to identify the ``critical path'' priorities and order of overlapping developments that will most economically and efficiently and expeditiously realize the problem's solution by special local problem identification and location within the totality of the problem-solving scenario.
>
> —Buckminster Fuller, Synergetics 537.31 [FA79]

We can think of problem solving here as a synecdoche, a figure of speech where in this case the part, problem solving, represents the whole, any arbitrary form of inquiry and action. Bucky, in this interpretation, is recommending that all inquiry and action start with Universe, start with all humanity’s experience. So, the way “to understand all” is through this *breadth* of consideration. The breadth of our inquiry and action begins with our cultural heritage including all the approaches, assumptions, perspectives, hypotheses, theories, doctrines, stories, rituals, conditioned reflexes, and all the other accoutrements of our cultural milieu, our social environment.

With our breadth, we need to be wary of the dangers of the paralysis of wholism (a phrase from *The Design Way*) which can frustrate the effectiveness of our comprehensive initiatives. The entirety of all humanity’s experiences, the whole of Universe, and all of our cultural heritage are so vast, so multitudinous that our exploration can become paralysed if we do not limit the breadth of our attempts “to understand all”. In our *Art of Comprehensivity*, our learning practices for building an ever more extensive,

ever more intensive, and ever more integrated understanding of our worlds and its peoples, we can manage the risk of the paralysis of wholism by setting our primary epistemic virtue to gathering an *adequately broad* collection of sources to start our comprehensive inquiry and action. Perhaps therefore, we should aim to be as broad as we can without succumbing to a paralysis of wholism.

In short, identifying an adequate breadth of resources characterizes the whole we use to aspire to the whole of understanding all. Our adequately broad purview may successfully prepare us for the whole of our comprehensive understanding of everything. Or, to put it more dramatically, the whole of our adequately curated breadth starts us on an exploration to understand the whole shebang. This process will be explored in the next section.

How does the wholeness of an adequate breadth of resources curated for the start and the scope of any initiative to comprehensively understand and participate in the world shape our exploration?

15.2 How Wholes Become Meanings

The other half of our guiding quote, "to put everything together" suggests both a process and a result or output for any inquiry or action. Let's first consider the process, the how of putting everything together. We can learn about the process of putting everything together from the gestalt theory of learning which is effectively summarized by Jan Zwicky in her 2013 video presentation "The Experience of Meaning" and in her expansion of it in the 2019 book "The Experience of Meaning" [Zwi].

Zwicky argues, "wholes are different than the sums of their parts; and we perceive wholes first. Wholes...are both logically and epistemologically prior to their parts". She quotes Michael Wertheimer: "parts do not become parts, do not function as parts, until there is a whole of which they are parts". She marshals an impressive amount of evidence in her presentation including the ease with which non-musicians can recognize melodies as "aural shapes" even when in the wrong key. In addition, she considers facial recognition, literature, the phi phenomenon where two flashing lights are perceived as a moving light, visual proofs in mathematics, visual puzzles, and Jonathan Schooler's research on "verbal overshadowing" where language sometimes impedes our ability to think effectively.

Zwicky gives a definition for wholes or gestalts: “A Gestalt itself …may be defined as a structure all of whose aspects are in dynamic interrelation with each other and with the whole.” She explains how the structure of a gestalt experience is comprised of “resonant internal relations” so that “the aspects of a gestalt are interdefined”. She adds, “the whole is experienced through the particular, which is an aspect of it. This is possible only if every part is internally related to every other part: if it is the nature of the whole that determines both what and that any part is.”

Bucky describes a related dynamic in Synergetics 141.00 with his “Principle of the Whole System, which states that the known behaviors of the whole plus the known behaviors of some of the parts may make possible discovery of the presence of other parts and their behaviors, kinetics, structures, and relative dimensionalities.” *The Design Way* adds further definition to this dynamic process:

> Although it's true that ``the whole is greater than the sum of its parts,'' we must also acknowledge that the whole is of those parts. …The whole takes its emerging essence from the nature of its parts. There is an inseparable relationship between the parts and the whole. We also need to remember that any whole is always part of something more comprehensive—another whole. This means that there are emergent qualities of a whole that can only be revealed as transcendent properties, different from those properties displayed by the individual and separate parts of the whole. These emergent qualities are the result of the relations and connections binding the elements together in unity.
>
> —The Design Way, Chapter 5 ``The Whole''

Zwicky observes that even though the words “insight” and “recognition” are often applied to gestalt perception and that these words imply a sense of truth, in fact, gestalt experiences may not be veridical, may not be true, may not truly represent reality. She cites several examples including the phi phenomenon where we come to realize that our gestalt perception is erroneous. Nonetheless, for Zwicky these possibly not true gestalt insights comprise our experience of meaning: “to have a gestalt crystallize out of chaos, or to sense the internal relations between one gestalt and another”.

While Zwicky’s presentation of her gestalt theory of meaning illuminates a lot about the process of forming wholes “to put everything together”, how does it fit into our schema for comprehensive learning?

In the resource on mistake mystique we observed that knowledge is formed by guesses, hypotheses, theories, assumptions, or other kinds of assertions which stand together with the questions they attempt to answer. In the resource on the crises of ignorance, we further explained that the questions and assertions of our refined ignorance stand together to form the hypostasis or foundation of our knowledge. In the resource on perspective shifting, our emerging schema for comprehensive learning more deeply examined this knowledge as a *thoroughly refined ignorance*. Our ever more nuanced questions more and more thoroughly refine and hone our integrated interpretations of the experiences, assumptions, perspectives, hypotheses, theories, stories, rituals, conditioned reflexes, artifacts, and other ideas we consider in our comprehensive explorations.

As we articulate the dynamic "resonant internal relations" of our gestalts with all our questions, ideas, and interpretations, our exploration may precipitate new gestalts of refined ignorance in an experience of meaning. This is the meaning making process of exploration seen as gestalt learning.

As we re-consider our initial whole of curated scope (our adequate breadth of curated sources) and all the dynamic gestalt insights we find in our iterative exploration to further refine our ignorance, we may glimpse the significance of our efforts as an experience of meaning resulting from our comprehensive exploration. In sum, thoroughly refining our ignorance with the dynamics of wholes is how we "put everything together" and tentatively apprehend the whole shebang.

How can the gestalt insights accumulating during any initiative to understand and participate in the world bring meaning of the whole shebang in our comprehensive inquiry and action?

15.3 The Output of Comprehensive Initiatives

Earlier we observed that half of our guiding quote "to put everything together" suggests a result or an output for an inquiry or action, the what that we put together. Now, let's consider the intended result or objective of our comprehensive practice to better understand and participate in the world. Our objective may stem from our desire to better understand or act in the world, or perhaps we have an intention to create a more desirable future. In each case, our comprehensive inquiry and action can be seen as a design initiative.

In their chapter on “The Whole”, in *The Design Way* by Harold G. Nelson and Erik Stolterman many ideas about the whole are surveyed to identify its significance in creating intentional change.Their ideas can help us to better assess the whole in the output of our effort to “put everything together”.

The Design Way emphasizes the emergent quality of wholes:

> In design, when we say that something is a whole we mean that it is a complex ensemble of relations, connections, and an underlying unifying force or principle—that which causes things to stand together—that when taken together results in emergent qualities.
>
> —The Design Way, Chapter 5 ``The Whole''

What emerges may be what we intended or not. Sometimes we may get stuck in the weeds. Sometimes our ideals may steer us toward unattainable futures. We have already looked at the paralysis of wholism that limits our breadth. Similarly, the dangers of analysis paralysis limit us in our depth and the dangers of value paralysis limit us in striving to accommodate all of the desires and values that we and others may bring to our initiative. In each of these cases, *the adequate* is the principle for more effective inquiry and action recommended by *The Design Way*:

> The most elusive and unfamiliar concept in design—from a holistic perspective—may be the idea of the adequate. ...a definition of the adequate, seen from the perspective of the whole, states that the elements of a whole are formed with respect to the aim and purpose of the whole, meaning that components, relationships, and connections may be suboptimized in order to optimize the performance or behavior of the whole.
>
> —The Design Way, Chapter 5 ``The Whole''

That is, the whole of the new understanding, action, or future that we desire to create in any comprehensive undertaking must be of adequate breadth, of adequate depth, and of adequate value. Creating effective outputs from our efforts evidently imposes upon us a diligent inquiry to find the adequate in the ocean of possibilities in the whole Universe, the whole of our cultural heritage, and in a world of manifold desires.

> The notion of the whole is a foundational property of design that is realized through the careful and creative ordering and organizing of elements through intentional relations and connections.
>
> —The Design Way, Chapter on ``The Whole''

How does the whole of the output or intended result of our comprehensive practice to better understand and participate in the world affect the design of our comprehensive inquiry and action?

15.4 The Whole Shebang

In considering the Bucky quote "to understand all and put everything together", we have explored three aspects of wholeness that are important for comprehensive understanding and participation in the world. First, we considered how starting with the Universe gave us an adequate breadth of sources to curate our comprehensive exploration. Secondly, we considered how the gestalt theory of learning, the principle of the whole system, and the notion of emergence of the whole can help us explore the dynamics of gestalts which may give us a new experience of meaning. Finally, we considered how *The Design Way* positions the importance of the whole as we design an emerging result from our comprehensive inquiry and action.

There are many other ideas about the whole or wholeness which might affect the whole shebang of our comprehensive exploration. *The Design Way* surveys at least 9 additional ideas of the whole that we might consider. But the three we have highlighted adequately characterize the whole shebang of our featured Bucky quote "to understand all and put everything together":

1. The whole of our adequately curated breadth of sources provides the whole shebang of our scoped topic in any comprehensive inquiry and action.

2. The whole of our dynamic refinement of ignorance as we process gestalts form the whole shebang of meaning-making in any comprehensive initiative.

3. The whole of the emerging result produced is the whole shebang of each comprehensive undertaking to better understand and participate in the world.

This essay was written to provide ideas in support of the 15 September 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 1h 56m video from the 15 September 2021 event:

16 Chronofiles: Data Mining Your Life for Comprehensive Thinking

06 October 2021 in Resource Center.

Many of Bucky's essays ("Bucky" is the affectionate name for Buckminster Fuller) provide a window through which we may further glimpse his approach to comprehensive thinking. To iterate more deeply into his comprehensive thinking this resource examines Bucky's short 5-page essay "Man With A Chronofile" published on 1 April 1967 in "Saturday Review". We recommend you read that essay for context before continuing.

16.1 A Chronofile to Document Your Life as a Case History

Buckminster Fuller's essay "Man With A Chronofile" tells the story of his realizations gained from his childhood art of collecting things. This childhood collection grew throughout his nearly 88 years to more than 1,400 linear feet of material which are now housed as "The R. Buckminster Fuller Collection" at Stanford University. The essay tells a story about what he learned from his collection. In his 1981 book "Critical Path", he described his Chronofile:

> [I]n 1907 I started a chronological record of my life and in 1917 named it the ``Chronofile.'' In 1917, at the age of twenty-two—fortified with the already-thick Chronofile—I determined to make myself ``the special case guinea pig study'' in a lifelong research project—i.e., documenting the life of an individual born in the ``Gay Nineties''—1895, the year automobiles were introduced, the wireless telegraph and the automatic screw machine were invented, and X-rays were discovered...
>
> —R. Buckminster Fuller, ``Critical Path'', pp. 128--9

It might be interesting to note how this 1981 passage takes most of its words directly from the 1967 essay. But, what I find most interesting about the idea of the Chronofile in this Saturday Review essay is how Bucky suggests that it was through consulting his archive with all its newspaper and magazine clippings, notes and letters, and miscellaneous bills that he was able to glimpse the planetary patterns emerging during his lifetime. Between the lines, I read Bucky saying that compiling a Chronofile of your life provides the observational data needed to see how the world works. Could your understanding of the world be facilitated by curating a Chronofile of your life history?

Is Dante's expression "the Book of Memory" in the first sentence of *La Vita Nuova* a rudimentary form of Chronofile? Is supplementing our Book of Memory with curated records and artifacts an important tool for determining how the world works?

Whether we document our lives in an archive, a diary, a collection of posts or videos on a blog or vlog, in the "52 Living Ideas" video archives, in the collections of your e-mail, computer files, and social media timelines, or strictly in your Book of Memory, each of us constructs or designs the case history of our life in relation to our world. We choose what to remember, what to forget, what to collect, how to organize it, and what to make of it all.

We can think of our Chronofile as our Book of Memory enhanced with documents and artifacts however it is built and maintained. By conscientiously curating our archives and preserving them for future review and study, our Chronofile records can help us evaluate hypotheses, imagine new ones, and inform our explorations into how the world works. For Bucky, the result was Guinea Pig B, one of the most thoroughly documented lives in history. For you, the result can be a new way to practice comprehensive thinking: Guinea Pig You.

Bucky's essay suggests that his visionary insights may have been significantly empowered by his record-keeping and record-reviewing. Was his perspicacity for understanding the world the result of his carefully curated enhancement to his Book of Memory, to his Chronofile?

A Chronofile is a tool for understanding our lives because the planning and judgment that goes into building, maintaining, and reviewing it gives us a new view of our life to help us better see how we intersect with the world. We might learn how we repeatedly make the same mistakes. We might learn the patterns that drive our successes. We

might remember all the alternative paths that might have been. We might glean the design approach we have been using to shape our lives. We might imagine how we can improve the design of our life and how we can track our progress achieving these objectives through future Chronofile records.

A Chronofile is also a tool for understanding the world. Each of us needs to understand the world we are thrown into by birth. Is this the era of sticks and stones, megaliths rolled into place by human labor, swords and war chariots, horse-drawn carriages, steam engines, wired to wireless, aeronautics, digital technologies, or the electric bicycle? What kind of human being will you and I need to be in order to be successful in this era of human history?

As we gather intelligence about the traditions that are available in today's world we might choose to invest more or less time learning the art of knapping quartz, flint, or other fine stone cores to make tools; by the way, the stone tool tradition is still producing products for the global market. Even if you only maintain your Chronofile in an ad hoc fashion and entirely in your head, you are recording the cultural accoutrements and traditions that shape your life as it intersects your world.

Some might object to collecting materials for a Chronofile because most things are best lost or forgotten. Sometimes we hear the advice "live in the moment" to be free of your life history. In an exquisite 2007 article in The New Yorkeron the Pirahã people in the Amazon (pronounced pee-da-HAN), we learn of a culture that disdains history and lives in the moment. But, even the Pirahã carefully curate their Book of Memory: they talk about current events. But their curatorial values are on the opposite end of the spectrum from Bucky who collected vast amounts of materials over decades to document his whole life and its intersection with world history.

Each person can decide how to curate their Chronofile to better organize their comprehensive learning. You might model your Chronofile on the Pirahã. Being oblivious to history might have its advantages. Everyone gets to design their own approach to comprehensive learning. The evidence of Buckminster Fuller's case history suggests that Chronofiles with extensively collected materials can be a powerful tool to better understand your life and your world. It may be that our complex civilization needs citizens who can more broadly learn from their archive enhanced case histories than ad hoc living in the moment can muster.

What value might supplementing your Book of Memory with a thoughtfully curated Chronofile bring to your understanding of the world and how it works? What documents and artifacts if added to your Chronofile might help you to better mine your life history for comprehensive learning?

16.2 The Omni-Integrity of Universe

What more can we learn from Bucky's "Chronofile" essay? Near the end, he reminds us of his definition for Universe "the cumulative aggregate of all humanity's nonsimultaneous experiences" which we explored in the resource on The Comprehensive Thinking of R. Buckminster Fuller. It places everyone's experiences, broadly considered, as the concrete reality of Universe, as the basis for all thinking. He goes on to assert,

> [T]he omni-interacting, weightless, generalized principles apparently governing universe—discovered only experimentally and progressively by human-intellect-directed science—disclose an a priori, anticipatory, amorphous, and only intellectually conceivable, omni-integrity of universe.
>
> —Bucky's essay ` `Man With A Chronofile'', 1 April 1967

Can we make sense of this? What does it say about our efforts for comprehensive inquiry and action to better understand and participate in the world?

In the resource Redressing The Crises of Ignorance, we learned that the *generalized principles* are patterns that govern many different special cases. They can be identified by reviewing vast inventories of experience, of Universe, to find patterns that might have broad applicability. We saw the failure to conscientiously and comprehensively review Humanity's vast inventories of experiences to distill out the most effective generalized principles as a crisis of ignorance. Because our Chronofiles confront us with records of our experiences, they can help us redress this crisis. In reviewing our Chronofiles we may identify new generalized principles. In studying our Chronofiles, we can look for experiences that support or contradict hypothesized generalized principles.

To make further sense of Bucky's quote, let's start with the object at the end of it, namely, "omni-integrity of universe". What could this mean? The prefix "omni" means all. Creatively interpreting Wiktionary's entry for "integrity" we find it means "adherence", "wholeness", and "completeness". In the resource on Shifting Perspectives and Representing The Truth, we defined truth as the coherence of a perspective or hypothesis with the experiences and beliefs that justify it. With some creative inspiration, we might see Bucky's omni-integrity as an adherence to all the truths of all the generalized principles in all Humanity's experiences considered from all perspectives as a complete whole.

Instead, there may be a fundamental incoherence in all our experiences. If there were then everything would be unpredictable, there would be no patterns, no principles, no truths. Maybe we live in such a world and delude ourselves that learning is possible? But the principles of the reflection and refraction of light disclosed by Ibn al-Haytham, gravitation, and many others suggest overwhelming evidence in support of reliable generalized principles. So there seems to be a coherence, an integrity, if not an omni-integrity operative in Universe.

Our civilization is so complex that we all sometimes experience feelings of fragmentation, incoherence, and incomprehensibility. Again, we wonder if the integrity of Universe is illusory? A previous resource The Value of Multiple Working Hypotheses, suggests that we ought to organize several hypotheses to better assess our questions. Our question is at the root of any science, of any knowing: is there any integrity at all to our minds, to our intellectual efforts? Is the Universe knowable or not?

Here are three hypotheses:

1. the world may have complete omni-integrity so that the Universe is an immaculate design organized by always reliable generalized principles (this is Bucky's hypothesis, it is also the assumption of most academic science, and some theology),

2. the integrity of the world may only be partial where principles have limited applicability and may change whimsically perhaps due to some God or gods or a principle like fundamental randomness or chaos (this hypothesis gives us a world of miracles, the occult world of magic, or a god playing dice like in some popular interpretations of quantum mechanics; it is favored by some academic scientists and some theology), and

3. the world may have no integrity at all and is therefore fundamentally incomprehensible and so all learning is delusion as nothing meaningful exists (the various variations on this hypothesis are called nihilism).

Each of these, and the many variations on them, forms a basic assumption about the nature of our world which may influence our approach to learning. To assess whether the world is fully, partially, or negligibly governed by generalized principles, we could consult our Chronofiles. Which of these hypotheses best agrees with your life history? How often and how reliably are generalized principles applicable in your Chronofile? What assessment does your Book of Memory render?

To evaluate these hypotheses, we need to first identify proposed generalized principles and then assess their reliability. This assessment is also important for identifying the limits to our current knowing. We called this minding the gap with our mistake mystique which was the first crisis of ignorance examined in the resource Redressing The Crises of Ignorance. Ultimately, these analyses may indicate the degree to which there may be limits on the integrity operative in Universe.

> The omni-interacting, weightless, generalized principles apparently governing universe—discovered only experimentally and progressively by human-intellect-directed science—disclose an a priori, anticipatory, amorphous, and only intellectually conceivable, omni-integrity of universe.
>
> — "Man With A Chronofile" by Buckminster Fuller, 1967

Now, to finish interpreting the Bucky quote above. Let's consider how Bucky's adjectives clarify his thinking about the nature of the generalized principles which he says are "omni-interacting, weightless". Principles are always conceptual and therefore weightless. Moreover, they all interact with each other. In Synergetics 220.05, Bucky called them "omni-interaccommodative" suggesting that they coordinate cooperatively so that all contribute. That suggests they are non-contradictory. One exception disqualifies a generalized principle, though in most cases one can simply add a caveat to make it, again, an omni-interaccommodative generalized principle.

Bucky uses more adjectives to clarify his thinking about omni-integrity: "a priori, anticipatory, amorphous, and only intellectually conceivable". The Latin phrase "a priori" means "presumed without analysis" or "presumed by hypothesis". To avoid a logical regress, every system of thinking must begin with metaphysical assumptions which some writers designate "a priori". Bucky side-stepped our multiple hypotheses analysis by simply asserting an a priori omni-integrity. "Anticipatory" suggests that

the omni-integrity operates with full awareness of the effects of all the generalized principles. “Amorphous” suggests that as the generalized principles are progressively accumulating they never form a fixed structure. Finally, “intellectually conceivable” observes that the omni-integrity like the generalized principles is conceptual and so not physical.

Even if Bucky’s hypothesized omni-integrity of Universe falls short and the knowability of our world is fundamentally limited by randomness, occult magic, intervening gods, or inherent chaos, the idea of an integrity in Universe provides the comprehensive explorer with an epistemic virtue, a criteria for good learning, with which to assess our inventory of hypothesized generalized principles with your Chronofile. This suggests that one of the objectives for comprehensive exploration is to negotiate the nature of the integrity of Universe: is it fully, partially, or negligibly governed by generalized principles?

16.3 Chronofiles and Integrity in Comprehensive Exploration

The epistemic virtue of integrity suggests that comprehensive practice ought to strive toward the wholistic integration of all our experiences and all our hypothesized principles in our private thinking and in our thinking with others. As we review and study our Chronofiles alone and with others new gestalt insights might form creating meanings that may integrate some or all of our experiences and principles.

Integrity as our value for integrating all experiences and principles may be seen as the guide driving our meaning making process forming the wholes of new gestalt insights. It may also be seen as the guide to forming a whole as the output of our comprehensive explorations. The wholeness in the process and outputs of comprehensive practice was further described in the resource The Whole Shebang.

It may not be possible to integrate all our experiences and principles with all the other others that we may encounter, but setting *integrity* as a core epistemic virtue aims our explorations toward a comprehensive understanding of the world and how you and me and everyone else participates in the world. That is the objective for our comprehensive inquiry and action. Putting your *Chronofile*, your document and artifact enhanced Book of Memory, in order can now be seen as a prerequisite for this goal.

This essay was written to provide ideas in support of the 13 October 2021 session of “Comprehensivist Wednesdays” at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 2h 1m video from the 13 October 2021 event:

17 Dante's Comedìa and Our Comprehensivity

11 November 2021 in Resource Center.

Our comprehensivity is our facility for comprehensive thinking and action. One way to build our understanding of comprehensive practice is to look for precursors in historical works. This resource will examine the comprehensive ideas used by Dante Alighieri (1265–1321) in his great works *La Vita Nuova [AP65]* and the *Comedìa [Ali72]* (more commonly known as The Divine Comedy even though Dante never used that title).

Since January 2021 The Greater Philadelphia Thinking Society and 52 Living Ideas have organized group explorations of Dante's greatest works to commemorate the septicentennial of his death seven centuries ago. The project has been organized through the web page Reading Dante in 2021 where many learning aides including two free on-line video courses were listed to support participants of the project. This resource surveys ideas for deepening our understanding of the practice, values, and history of comprehensive inquiry and action that might be highlighted by participating in a project exploring Dante's great works.

17.1 Assessing Dante's Contribution

Around 1294 Dante Alighieri (1265–1321) published a collection of poems with supporting prose for context under the title *La Vita Nuova* (The New Life). In 1320, the year before he died, Dante completed his magnum opus, the *Comedìa* (Comedy), which consists of three parts *Inferno* (Hell), *Purgatorio* (Purgatory), and *Paradiso* (Paradise). As the commemorative project Reading Dante in 2021 approaches its end, we might

reflect on what to make of Dante's contribution. Giuseppe Mazzotta's 19-minute introductory lecture for his free on-line 2008 video course "Dante in Translation"(with 24 YouTube videos) on Open Yale Courses gives an assessment which we can reflect upon after reading Dante.

Mazzotta suggests many different ways of characterizing Dante's work: a journey to "seeing God face to face and come back to talk about it", an epic poem, an autobiography, a romance, and an encyclopedia or "a circle of knowledge". Throughout his course, Mazzotta calls the poem prophetic, philosophical, historical, sublime, humanistic, theological, scientific, geometrical, musical, a poetry of hope, justice, the future, and more.

What is the nature of Dante's *Comedìa*?

10 years ago, I read Dante's *La Vita Nuova* and the *Comedìa* using the Mark Musa translation and watched and took extensive notes on the Mazzotta videos in a four-month period (24 videos totaling nearly 27 hours). I summarized my learning from that experience in the essay Dante's Great "La Commedia" or Poetry as a way of Knowing.

For this year's commemorative reading, I re-read the Musa translation in eleven months giving me plenty of time to read each Canto (the *Comedìa* is divided into 100 sections or Cantos) at least two or three times, I reviewed some of my old notes and the transcripts to Mazzotta's videos, I watched the 54 video lectures (nearly 92 hours worth) and notes by Teodolinda Barolini on Digital Dante at Columbia University, I searched for context in the commentaries on the Dartmouth Dante Project and in Wikipedia, and read and searched the poem on the Princeton Dante Project (which includes the Robert and Jean Hollander translation), and I wrote commentary and questions for the community that formed around the Reading Dante in 2021 project.

Reading *La Vita Nuova* before the *Comedìa* is highly recommended. For those who are not experienced readers of poetry, Dante's practice in *La Vita Nuova* of dividing his poems into parts and then describing the meaning of each part provides excellent guidance in learning the art of interpreting poetry. These skills are helpful for understanding the much more difficult poetry of the *Comedìa*. In addition, there are many important passages in the *Comedìa* where a line, scene, image, or idea from *La Vita Nuova* is referenced. *La Vita Nuova* also helps the reader attune their historical mindset

to the culture of the Florence, Italy of 700 years ago, the poetry of the Troubadour tradition, and its ending provides a prescient prelude to the *Comedìa* putting Dante's whole project in dramatic context. This context from *La Vita Nuova* makes reading it before the *Comedìa* extremely valuable for most readers.

As I re-read Dante this year, I looked for evidence in the text for Mazzotta's broad list of characterizations of the *Comedìa*. Each of his identifications resonates as true to me here at the end of my reading, but as I watched Teo Barolini's video lectures and read her notes, I tuned into the alternative themes, ambiguities, and counter-narratives that reveal the poem to be more complex than any characterization could possibly capture. In fact, for each of Mazzotta's characterizations, I found that even when the theme is prominent, Dante complicates it with other themes, connections, and ambiguities. The lens of interpreting the *Comedìa* through key themes and ideas might thus obscure its nuances and distort our perspective on the work. For some readers, having a list of themes might provide a helpful list of targets to key in on during their reading. But, I came to wonder if Dante's poem is intentionally anti-thematic or maybe just extremely multi-thematic.

I identified four qualities of the poem that seemed preeminent to me. First, throughout the poem it includes verbal puzzles where the reader is expected to recognize details from the culture of Dante's time including the mythological figures and histories of the ancient world, specifics about the Judeo-Christian-Islamic heritage in Europe and the Middle East, as well as many details of the political and religious life of the late thirteenth and early fourteenth centuries centered in Florence but broadly concerned with Italy and Europe as well.

These poetic riddles both make the poem engaging and exasperating when you learn, again and again, that you simply do not know enough of the culture of Dante's time to decipher his text. It may be fun to solve riddles like in *Inferno* 1.26–27 "the pass / that never let a living soul escape" (Mark Musa translation) which is a periphrasis or circumlocution for the dark wood referenced in verse 2 (Robert Hollander's commentary calls this "a much disputed passage": and this is one of the easy ones!).

However, the text is filled with an incessant stream of riddles. Sometimes the riddles can be solved on your own by reading the whole poem at least twice: clues from later Cantos frequently transform the reader's understanding of what came before. But, many are harder to solve like the one in *Paradiso* 30.1–9 where we find an elaborate and baroque nine line periphrasis that builds upon a now obscure ninth century Islamic

astronomical calculation to refer to an hour before dawn. How many hours per page of poetry must a reader invest in trying to solve Dante's riddles before abandoning their own interpretive imagination to turn to the seven centuries of accumulated predigested puzzle-solving work of the many commentators on the poem to grasp its meaning second-hand? And frequently the commentaries disagree! But, the clues they provide often give the historical and literary context needed to inform your own interpretation.

Secondly, the poem is deeply steeped in the orthodoxy of early fourteenth century Florentine religious values. However, it is unclear to me if this is a protective facade from which Dante can take a moral high ground to strongly critique the Church and the politics of his era, or if the author is, in fact, an orthodox Christian monarchist who used his poem and its lofty themes and language to rail against his religious and political enemies. In *Paradiso* 27.40–66 in the "voice" of Saint Peter and in 30.130–148 in the "voice" of his guide Beatrice, he adds decisive doses of invective against the Church. This reader could not help but wonder if Dante's incessant papal critiques and desired imperial unification of Italy might best be characterized as an eloquent and sublime political hit piece.

Thirdly, given how much of world culture and world literature is referenced in Dante's *Comedìa*, it is clearly a work of comprehensive exploration. It's opening line "Midway along the journey of our life" (Mark Musa translation) evokes the guiding allegory of the journey of our lives with the invitation that the reader, too, can learn how to live, how the world works, and how to understand it all either vicariously through the pilgrim's adventures or allegorically through interpretation. In other words, the poem is overtly a work of comprehensive learning.

Lastly, perhaps the best characterization of the poem is that it is a work of great literature. Its engaging, dynamic dialogue and imagery have inspired generations. Literature is always subject to the interpretations of its readers and maybe what you the reader make of the poem is more important than what it has meant to past readers and commentators who might have characterized it too parochially.

17.2 The Virtues of Comprehensivity in the Comedìa

All traditions of inquiry and action are characterized by the values which guide its practice. These values can be called the epistemic virtues for that system of learning and doing. In previous resources, we have identified ten important epistemic virtues for comprehensive exploration. Let us examine Dante's *Comedìa* to see to what extent it embraces each of these values. A less complete list of these epistemic virtues was included in the resource on Comprehensivism in the Islamic Golden Age.

1. Adequate Breadth: the aspiration to engage and accommodate a sufficiently large and diverse collection of other traditions in our explorations. In Buckminster Fuller's terms, this aspiration is the injunction to begin all our explorations with Universe which he defined as "all of humanity's consciously-apprehended and communicated experience." Breadth and depth were introduced in the resource Humanity's Great Traditions of Inquiry and Action and elaborated on in the resource on The Comprehensive Thinking of R. Buckminster Fuller.

Breadth is pervasive throughout the *Comedìa*.*Inferno* is a broad exploration of bad actions (sin). *Purgatorio* is a broad exploration of virtues and vices, good and bad motivations. *Paradiso* is a broad exploration of the intellectual principles believed to make the world work. Another breadth found in the *Comedìa* is in the range of prior literature that Dante references: from the *Odyssey* to Virgil's Aeneid and Ovid's Metamorphoses to Aristotle, Cicero's De Amicitia (On Friendship), Augustine's City of God and Confessions, Ibn Rushd (Averroës) to Boethius's *Consolation of Philosophy* to the Bible (particularly, the Song of Songs, Book of Psalms, Book of Wisdom, Gospel of Matthew, and Book of Revelation) and much more. These literary references and the cultural figures they evoke is immense, it is epic: the *Comedìa* surveys some two millennia of prior literature. The *Comedìa* is continually negotiating the boundaries of the breadth of acceptable human knowing and doing. One of its far-reaching images for unacceptable transgression of knowledge is given by Ulysses in *Inferno* 26.97–99 "[nothing] could quench deep in myself the burning wish / to know the world and have experience / of all men's vices, of all human worth" (Mark Musa translation). In Lecture 8 of his course on Dante, Giuseppe Mazzotta says "Dante implies and seems to agree with, if one were to read the trajectory of the Divine Comedy [the Comedìa], that there is no knowledge worthy of its name unless it is connected to some degree of transgression. That somehow transgression is part of knowing". Perhaps

Dante's exploration of the transgression of knowledge is the *Comedìa's* gloss on the importance of an adequate breadth. Transgression may be seen as the attempt to be all knowing which is humanly impossible: comprehensive exploration, instead, requires an adequate breadth.

2. Adequate Depth: the aspiration to comprehend each subject explored in as much detail as is judged reasonable. The limitations on the breadth and depth of our comprehensivity was first explored in the resource The Necessities and Impossibilities of Comprehensivism and elaborated on in the resource The Whole Shebang: "to understand all and put everything together".

The evocative poetic voice of the *Comedìa* can produce substantial depth with what might seem a paucity of words. For example in *Inferno* 4.144 "Averroës who made the Commentary" indirectly reminds us of the translation movement of the twelfth century where Aristotle's teachings were reacquired from the Islamic world and then became very influential in the thirteenth century with the work of Albertus Magnus, Thomas Aquinas, and many others. Intertextual, intercultural references like these open a world of depth with just one line of poetry.

The *Comedìa* also achieves depth by repeatedly exploring topics. The theme of justice is, perhaps, the most deeply explored subject in the *Comedìa* as Dante keeps addressing it in Canto after Canto, passage after passage. Other deeply explored subjects include the nature and role of language (especially poetry), the cultural history of Italy, the integration of Aristotle's thinking with Christianity, the body, the importance of learning and understanding, the importance of love and desire, the role of the Greek and Roman traditions in medieval Christianity, and many more.

3. Empiricism: the aspiration to both infer hypotheses and to assess them from the concrete evidence in humanity's inventory of experience, in the Universe as defined by Buckminster Fuller. Empiricism was explored in the resource The Inductive Attitude: A Moral Basis for Science and Comprehensivism.

A most prominent and intensive example of empirical thinking in the *Comedìa* occurs in *Paradiso* 2.49–148 where Beatrice describes a battery of experiments and arguments to test hypotheses and draw conclusions to explain the mottled appearance of the Moon. The text includes two lines that clearly value empiricism, "by experiment, the source which fills the rivers of man's art" in verses 95–96 (Mark Musa translation).

4. Multiple Working Hypotheses / Multiple Perspectives: the recognition that there are always multiple perspectives from which to consider a subject and multiple hypotheses that may help us understand it. Therefore, comprehensive inquiry and action aspires to identify and consider sufficient numbers of perspectives and hypotheses to adequately inform our analytical, synthetic, and integrative imaginations. Multiple working hypotheses were explored in the resource The Value of Multiple Working Hypotheses and multiple perspectives were explored in the resource Shifting Perspectives and Representing The Truth.

Paradiso 2.49–148, which we just mentioned, explores two hypotheses. In *Paradiso* 8.91–148, in the interchange with Charles Martel, Dante learns in verses 122–126 "the very roots / of man's activities must be diverse: / one man is born a Solon, one a Xerxes, / one a Mechizedek, another he / whose flight cost him the life of his own son" (Mark Musa translation). This suggests that society needs at least the talents and perspectives of lawyers, warriors, priests, and artisans (if your cultural knowledge and imagination is broad enough to interpret Dante's name/qualities periphrasis or if you have access to a commentary that explains it). Further evidence for multiple perspectives can be found in the heaven of the Sun, *Paradiso* 10–14, where Dante meets 24 diverse scholars some of whom strongly disagreed with each other in life.

In the following passage, Dante emphasizes the importance of making distinctions to clarify one's thinking so that we can judge better. Such distinctions are an elementary form of perspective or alternative hypotheses:

> Let this be leaden weight upon your feet
>
> to make you move slow as a weary man
>
> both to the 'yes' or 'no' you do not see,
>
> for he ranks low, indeed, among the fools,
>
> who rushes to affirm or to deny,
>
> no matter which, without distinguishing.
>
> —Paradiso 13.112--117, Mark Musa translation

In addition, The poet's art of juxtaposition causes the *Comedìa* to reverberate with thoughts engaging multiple perspectives and hypotheses throughout. This is one of Dante's strongest epistemic virtues for comprehensive thinking. It is probably why the poem resonates so much for so many readers.

5. Adequate Wholeness for Meaning Making: the recognition that the meaning making process involves the dynamics of gestalt shifts and gestalt crystallizations that bring into focus identified complexes of interdefined, resonant relations that form significant wholes. Jan Zwicky highlights this idea as "the experience of meaning" as discussed in the resource on The Whole Shebang: "to understand all and put everything together".

Dante has one glimpse of the experience of meaning in this metaphor:

> As one who suddenly beholds a thing
>
> incredible will first believe and then
>
> misdoubt and say: ``It is—it cannot be!''
>
> —Purgatorio 7.10--12, Mark Musa translation

This is a wonderful insight, but it blurs doubts and hesitations with mistake mystique and it fails to see gestalt learning as the art of meaning-making.

6. Mistake Mystique: realizing that there will always be inherent gaps in our understanding, communication, and desired outcomes (designs), mistake mystique is the aspiration to identify and further minimize these gaps through iterative comprehensive exploration and design. Formulating good questions can help us identify and negotiate these gaps. Mistake mystique was introduced in the resource Mistake Mystique in Learning and in Life and elaborated on in the resource Redressing The Crises of Ignorance.

Evidence that in the thirteenth century mistake making was strongly and negatively sanctioned can be seen in Henry Wadsworth Longfellow's commentary on Inferno 15 where Dante meets his former teacher: "This Ser Brunetto Latini was a Florentine, and a very able man in some of the liberal arts, and in philosophy; but his principal calling was that of Notary; and he held himself and his calling in such great esteem, that, having made a mistake in a contract drawn up by him, and having been in

Figure 17.1: Epistemic Virtues of Comprehensive Learning

consequence accused of fraud, he preferred to be condemned for it rather than to confess that he had made a mistake". In *Purgatorio* 3.8–9 after Cato confronts the penitent for gathering around Casella negligently singing one of Dante's canzone, a type of poetic song, Dante muses "O dignity of conscience, noble, chaste, / how one slight fault can sting you into shame!"

I found no real sense of mistake mystique as an epistemic virtue in the *Comedìa*.

The idea of the purgation of sin in *Purgatorio* provides a kind of ritualized response to sin, to mistake-making. But, the *Comedìa* is downright cruel and inhuman when it comes to sin. Yes, there are interesting passages about repentance: in Inferno 27.67–129 where Guido da Montefeltro is a fraudulent repentant condemned to Hell and in *Purgatorio* 5.88–129 Bonconte da Montefeltro, Guido's son, is a saved repentant; but, the issue here is fraud not mystique, not a heightened value or interest in the mistake as a vital tool for learning and doing.

Dante's notion of sin often leads to a violent self-flagellation as on the terrace of pride where we learn in *Purgatorio* 10.100–139 that the souls carry as punishments weights on their backs compressing them, in the most severe cases, "with chest pressed tightly down against its knees" (verse 132, Mark Musa translation) to the degree of their sin. So Dante considers mistakes and their ritual atonement, but his treatment is horrific, tortuously inhumane, and anything but the kind of mistake mystique that is both healthy and necessary for effective comprehensive inquiry and action.

However, there is a gesture toward valuing mistakes in the comical passage near the end of *Paradiso* 28.121–139 where Gregory the Great laughs at his mistake in ranking the angels. And a tantalizing but ambiguous verse after the ecstatic vision near the beginning of the terrace of wrath that may evoke some sentiment for mistake mystique: "I came to know my errors were not false" in *Purgatorio* 15.117 (Robert and Jean Hollander translation). Throughout the poem, the pilgrim asks questions expressing his doubts. While these could indicate mistake mystique, the assumption is always that a guide will explain and the pilgrim will "learn" The Truth. Sometimes these explanations include ambiguities, but the poem seems to believe that there is always a right answer and the doubts just require some instruction which sometimes involves learning the limits of human knowing.

Even considering these approximations to mistake mystique, I feel Dante has no mystique, no positive heightened value or interest in mistake-making, at all. Maybe mistake mystique is a modern value: we might not find it articulated in older literature?

7. Generalized Principles: the aspiration to refine the meaningful wholes we identify through consideration of the gaps seen by our mistake mystique into principles that abstract and accommodate vast subsets of Humanity's accumulated inventory of experiences. Generalized principles were introduced in the resource The Comprehensive Thinking of R. Buckminster Fuller and further developed in the resource on Redressing The Crises of Ignorance.

Even though Dante seems to have no awareness of the crucial intermediate processes of forming wholes in meaning-making and in negotiating the inherent gaps with mistake mystique, following ancient traditions he succeeds in identifying generalized principles. In this passage Dante summarizes the generalized principle or theory of reflection developed and experimentally validated by Ibn al-Haytham in his famous Kitāb al-Manā□ir (Book of Optics):

> A ray leaps back from water or from glass,
> reflecting back the other way as it
> ascends in the same way it first came down,
>
> forming an angle with the plummet-line
> exactly equal to the incidence—
> as theory and experiment both show;
>
> —Purgatorio 15.16--21, Mark Musa translation

The idea that "theory and experiment" must agree was emphasized by Ibn al-Haytham in the early 1000s. It is an emphatic formulation of the value of empiricism which is a very effective but more elementary approach than mistake mystique. Here are several more examples of generalized principles from *Paradiso*:

In 1.98–141, Beatrice answers Dante's question in verse 99 "how I can rise through these light bodies here" with a general explanation of how the Universe operates as indicated in verse 121 "The Providence that regulates the whole" (Mark Musa translation). In 2.49–148 where, as mentioned previously, Beatrice explains the variegated appearance of the Moon with in verse 147 "the formal principle" of "different virtues

mingle differently" in verse 139 (Mark Musa translation). In 7.19–148, Beatrice explains a complex theological doctrine of "how just vengeance can justly be avenged" as the question is posed in verse 21 (Mark Musa translation). Each piece of her argument is an asserted generalized principle, since all arguments are based on generalized principles.

8. Integrity: the aspiration to accommodate and account for each experience, perspective, hypothesis, idea, and generalized principle relevant to our inquiry and/or action as an all-encompassing coherent whole or schema. That is, the aspiration to integrate our comprehensive exploration into a comprehensively integral whole, into an *integrity*. The idea of integrity was introduced in the resource Chronofiles: Data Mining Your Life for Comprehensive Thinking.

One of the themes in *Paradiso* is how Dante's doubts and his desire to understand are addressed by Beatrice and other splendors. One of the clearest instances of this is after Beatrice explains the difference between conditional and absolute will:

> Such was the flowing of the holy stream
>
> that pours down from the Fountain of All Truth
>
> that it now laid both of my doubts to rest.
>
> —Paradiso 4.115-117, Mark Musa translation

Beatrice's words are "the flowing of the holy stream" and God is "the Fountain of All Truth". But this is received wisdom and not the kind of human wrought effort to puzzle out sometimes contradictory ideas into an interaccommodative comprehensive integrity. Nevertheless, the epistemic virtue of integrity is clearly in the *Comedìa* even if it usually takes the form of received wisdom.

9. Comprehensive Comprehension (or thoroughly refined ignorance): the aspiration to structure all our learning from the previous eight epistemic virtues with a fabric of questions (which systematically interrogate the gaps identified by our mistake mystique) to situate all our experiences, perspectives, hypotheses, ideas, generalized principles, and integrities in our thoroughly refined ignorance, our ever-evolving and always nuanced design judgment, our *comprehensive comprehensions*. The idea of

refined ignorance was introduced as the “Hypostasis of Knowledge” in the resource on Redressing The Crises of Ignorance and expanded on in the resources on Comprehensivism in the Islamic Golden Age, Shifting Perspectives and Representing The Truth, and The Whole Shebang: “to understand all and put everything together”.

There are a few hints that Dante understood aspects of comprehensive comprehension. For example, in *Inferno* 11.93 “it pleases me no less to question than to know” (Robert and Jean Hollander translation) we see that Dante understood the importance of questions. Dante also sometimes sees the value of ignorance, for example, on the terrace of avarice after the dramatic earthquake and loud shout from all sides, the narrator muses:

> Never before, unless my memory errs,
> had my blind ignorance stirred up in me
> so violent a desire for the truth
> as I felt now, racking my brain to know.
>
> —Purgatorio 20.145-150, Mark Musa translation

Dante even imagines our ignorance as a profoundly important principle for humility:

> No Mr. or Miss Know-It-All should think,
> when they see one man steal and one give alms
> that they are seeing them through God's own eyes,
> for one may yet rise up, the other fall.
>
> —Paradiso 13.139-142, Mark Musa translation

In addition, to never putting the value of questions and ignorance into anything like the form of our comprehensive comprehensions, Dante has several passages that attribute a negative valence to ignorance and asking the wrong question which are antithetical to the curiosity and values of psychological safety that seem crucial for our comprehensivity. In *Inferno* 7.70–71, we find “O foolish race of man, / how overwhelming is your ignorance!” and in *Paradiso* 21.103–105 “I put aside that question which his words / had so proscribed me from” (Mark Musa translation).

10. Collaborative Comprehensive Exploration: the aspiration to listen to and work with others by sharing our individually articulated experiences, perspectives, hypotheses, ideas, generalized principles, integrities, and comprehensive comprehensions to collaboratively compose new comprehensive comprehensions or their underlying components that we might not have imagined independently. This idea was introduced in the resource on Redressing The Crises of Ignorance as a reformulation of Buckminster Fuller's ideas about education automation.

Except in the heaven of the sun, *Paradiso* 10–14, where 24 dancing scholars interact with the pilgrim, I get no sense that Dante understood the social design of comprehensive comprehensions through collaborative exploration. Instead, I get the sense that in Dante's *Comedìa* all wisdom comes from wise guides who, in turn, see reflected glimpses of divine light.

In sum, we have seen that Dante's *Comedìa* has many but not all of the epistemic virtues we use in comprehensive exploration. The extent to which Dante's text embraces comprehensive practice shows that it is an important work in the history of the tradition of comprehensive inquiry and action.

What, if anything, in Dante's Comedìa shows affinity for our comprehensivity, our facility for comprehensive exploration?

17.3 The Value of the Comedìa for Comprehensive Practice

Reading the *Comedìa* with its riddles, metaphors, and allusions that require a broad understanding of the literature, history, and culture of medieval Florence, gives a thorough workout for one's comprehensivity, for one's facility for comprehensive inquiry and action to better understand and participate in the world. What are some of the benefits of engaging the *Comedìa* as a tool for comprehensive learning?

1. To better understand the sciences, philosophies, poetry, music, art, literature, politics, religion, and many other cultural currents of the Middle Ages.

2. To give those who are weak at reading poetry a sustained project to redress those deficiencies.

3. To better understand how the poetic tradition developed in the Middle Ages in Europe.

4. To learn from the poetry of the epic tradition, which documents both the famous and lesser known characters of history to give a sense of the individual's role in world history.

5. To assay the most comprehensive cosmic context of a human life as one poet saw it in the Middle Ages.

6. To learn the great difficulty of distinguishing the commentaries that interpret literature for us from the original work itself: do I accept what I read and my interpretation or do I accept the commentator's assertions or both/neither (meaning both and neither simultaneously)?

7. To assay the role of justice, love, and desire in our lives and to contrast our views with Dante's medieval views.

8. To get a mental workout thinking about the design of our lives in considering Dante's exploration of the sins, virtues, vices, and principles of his wonderfully fictitious Universe.

9. To become familiar with the *Comedìa's* iconic images, scenes, and characters which are constantly referenced in modern culture.

10. To better understand the development of the modern world.

    - I learned that long before Descartes' "introduction" of the dualism of mind and body, Dante was obsessed with the importance of the body in Christian belief.
    - I reminded myself that long before Christopher Columbus, Dante understood that the Earth was spherical contradicting the myth that Washington Irving introduced in his highly fictionalized biography of Columbus.
    - I reminded myself that in the medieval value system sin meant in toward the center of the Earth and virtue and bliss was out toward the heavens. So scientists such as Carl Sagan, Martin Rees, Neil deGrasse Tyson, Stuart Firestein, and many others who falsely proclaim that heliocentrism removed Earth from a privileged position are badly mistaken. On the contrary heliocen-

trism placed the ugly sin of the Earth with Lucifer at its very center into the purity of God's domain in heaven where there is no sin! Scientific thinking has been sullied by this mistake since 1686 when Fontenelle invented what Dennis R. Danielson dubs the Copernican Cliché.

- To assay the history of comprehensive practice and learn about the values of comprehensivity which are articulated in this 700 year old work. We looked at some of these historical roots in the resource on Comprehensivism in the Islamic Golden Age. The translation movement of the twelfth century which provided Latin translations of Islamic works and other ancient works that had been lost in Europe, also provided important context for Dante's fertile imagination. As we have detailed above, Dante was able to leverage this broad cultural context to give us his outstanding exemplar of comprehensive imagination that continues to inspire and sometimes exasperate its readers.

What value, if any, do you find in the *Comedìa* for your comprehensive practice?

This essay was written to provide ideas in support of the 17 November 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas(crossposted at The Greater Philadelphia Thinking Society) and the 5 December 2021 event "Reflecting on Dante's Inspired Poetry for his Septicentennial"(crossposted at The Greater Philadelphia Thinking Society).

Addendum: 2h 23m video from the 17 November 2021 event:

Addendum: 8m collection of excepts from the above video summarizing the list of proposed Epistemic Virtues for Comprehensive Learning:

18 The Ethics of Learning from Experience

09 December 2021 in Resource Center.

The way in which any tradition of inquiry and action is practiced is beset with issues about the correct or proper way to conduct inquiry and act within the tradition. Learning from experience has been proposed as a core epistemic virtue for our comprehensivity, our inclination to understand it all and each other. This resource explores several issues which may arise as we consider how we should learn from experience. Buckminster Fuller's thinking about experiential learning will instigate much of the exploration.

The value of learning from experience, also known as the inductive attitude or empiricism, was introduced in the resource on The Comprehensive Thinking of R. Buckminster Fuller and was further developed in The Inductive Attitude: A Moral Basis for Science and Comprehensivism and has been reprised in the summarizing resources Comprehensivism in the Islamic Golden Age and Dante's Comedìa and Our Comprehensivity.

18.1 Beginning with All Humanity's Experience

Our comprehensivity is about our aspiration to understand it all and each other. Our perspective effectively requires us to begin with an all-encompassing inclusion of all the experience of all humanity. This view is captured by Buckminster Fuller's definition "The universe is the aggregate of all of humanity's consciously-apprehended and communicated experience". Bucky recommended that we begin all inquiry with this notion of Universe so that we don't omit anything from consideration. For comprehensive learning, we begin with Universe because it includes all the other others who we aspire to better understand.

In comprehensive learning, we must include the experiences of indigenous peoples, historical peoples, extinct peoples, minorities, paupers and billionaires; criminals, terrorists, tyrants, as well as heroes and saints; you and me: all these experiences become valid starting points for our comprehensive exploration. We must also include our experiences with microbes, plants, animals, eclipses, the Sun, Moon, planets, and other star systems. Comprehensive practice invites us to include everything that anyone has experienced as an event sequence or imagined as a possibility. In short, comprehensive learning is about learning from experience.

A major alternative is to begin with some principles that are assumed to be apodictic or necessarily true. Sometimes these are called first principles, axioms, self-evident principles, metaphysical or theological principles, logos, divine logos, faith-based beliefs, rationality, the principles of critical thinking, and many other formulations. Such, assumed to be certain, truths are the beginning point for many systems of learning. We might call such systems of inquiry and action apodictic since they begin with certainty.

It may seem that apodictic systems of learning are incompatible with comprehensive learning because a system with necessarily true starting points is inclined to discount or reject beliefs that are at odds with its first principles. Moreover, apodictic systems may reject alternative starting points. From the comprehensive perspective which values all experience and all starting points, it may seem arrogant and imperial if not colonial and violent to insist that other beliefs and starting points are invalid.

But, if we are serious about understanding it all and each other, we need to examine even those traditions whose first principles put them at odds with both our comprehensive learning and other antithetical systems of learning. For the comprehensive learner, delving into such worlds is par for the course. Comprehensive practitioners are endlessly curious about how other systems of knowing work, even apodictic ones.

I think comprehensive practitioners should take the long view with respect to apodictic systems of learning: some day we might learn of an absolutely correct principle governing our worlds. If it concurred with everyone's experience we might conclude it was demonstrably true or apodictical. In fact, for all we know, such principles may already have been identified. So we should be curious and appreciative of apodictic systems of learning even if our experience with so many of them leaves us a little skeptical about many of their claims.

To contrast learning from experience and apodictic or self-evident systems of learning further, let's consider Bucky's self-discipline for "experientially based thinking":

> My definition of the word believe means to accept an explanation of physical phenomena without any experiential evidence. At the outset of my resolve not only to do my own thinking but to keep that thinking concerned only with directly experienced evidence, I resolved to abandon completely all that I ever had been taught to believe.
>
> —R. Buckminster Fuller, Critical Path, 1981, p. 151 [Ful81]

Bucky's proposed approach to learning from experience radically rejects everything that is not supported by experiential evidence. He calls this *doing my own thinking*. Bucky takes the strident stand that to really learn from experience we should abandon all our beliefs unless there is support for them in our inventory of experience.

Bucky's approach rejects the apodictic principles of other systems of learning unless they can be supported by experiential evidence. Bucky suggests that their logic is backwards: start with experience and then infer reliable generalized principles. Apodictic systems start with core principles which often include some way of interpreting and examining experience. Experience is a secondary consideration in apodictic systems. Bucky's learning and my recommendation for comprehensive learning starts with experience, with all Humanity's experiences.

It is important to realize that Bucky includes the experience of others as acceptable "directly experienced evidence". We can see this by integrating into our interpretation of Bucky this excerpt from *Synergetics* (recall, as mentioned above, Bucky's definition of Universe is "the aggregate of all of humanity's ...experience"):

> People say to me, ``I think you have left something out of your definition of Universe.'' That statement becomes part of my experience. But never will anyone disprove my working hypothesis because it will take experimental proof to satisfy me, and the experiment will always be part of the experience of my definition, ergo included.
>
> —R. Buckminster Fuller, Synergetics 306.01 [FA75]

Bucky is not stridently rejecting all beliefs, just subjecting them to testing against experiential evidence. Interpreting Bucky can be challenging. How do you make sense of his self-discipline to do one's own thinking by abandoning all beliefs?

More broadly, how should we start our learning?

Should we start with apodictic or necessary truths as our first principles?

Should we start with experience and reject all our received wisdom until we can validate it with trustworthy experience from ourselves and others?

If we are to accept Bucky's idea of starting with experience but reject his strident abandonment of all beliefs, how might we go about learning from experience?

18.2 The Ethics of Empiricism

We have been considering Bucky Fuller's self-discipline for learning from experience by rejecting any received wisdom that cannot be supported with experiential evidence. There are other approaches to learning from experience. In the resource The Inductive Attitude: A Moral Basis for Science and Comprehensivism, we saw that George Pólya also starts his learning from experience:

> [Induction is the endeavor] to extract the most correct belief from a given experience and to gather the most appropriate experience in order to establish the correct belief regarding a given question.
>
> —George Pólya, Induction and Analogy in Mathematics, p. 3 [Pól54]

So far Pólya and Bucky agree: experience is the central tool for learning. In this long quote Pólya stakes out a far more tolerant position about our beliefs than Bucky:

> The inductive attitude. In our personal life we often cling to illusions. That is, we do not dare to examine certain beliefs which could be easily contradicted by experience, because we are afraid of upsetting our emotional balance. There may be circumstances in which it is not unwise to cling to illusions, but in science we need a very different attitude, the inductive attitude. This attitude aims at adapting our beliefs to our experience as efficiently as possible. It requires a certain preference for what is matter of fact. It requires a ready ascent from observations to generalizations, and a ready descent from the highest generalizations to the most concrete observations. It requires saying ``maybe'' and ``perhaps'' in a thousand different shades. It requires many other things, especially the following three.
>
> First, we should be ready to revise any one of our beliefs.

> Second, we should change a belief when there is a compelling reason to change it.
>
> Third, we should not change a belief wantonly, without some good reason.
>
> These points sound pretty trivial. Yet one needs rather unusual qualities to live up to them.
>
> The first point needs ``intellectual courage.'' You need courage to revise your beliefs. Galileo, challenging the prejudice of his contemporaries and the authority of Aristotle, is a great example of intellectual courage.
>
> The second point needs ``intellectual honesty.'' To stick to my conjecture that has been clearly contradicted by experience just because it is my conjecture would be dishonest.
>
> The third point needs ``wise restraint.'' To change a belief without serious examination, just for the sake of fashion, for example, would be foolish. Yet we have neither the time nor the strength to examine seriously all our beliefs. Therefore it is wise to reserve the day's work, our questions, and our active doubts for such beliefs as we can reasonably expect to amend. ``Do not believe anything, but question only what is worth questioning.''
>
> Intellectual courage, intellectual honesty, and wise restraint are the moral qualities of the scientist.
>
> —George Pólya, Induction and Analogy in Mathematics, Chapter 1, p. 7--8

The big difference between Bucky's self-discipline to do his own thinking and Pólya's inductive attitude is the principle of wise restraint. That is, the view that "we have neither the time nor the strength to examine seriously all our beliefs", so we should only explore "our active doubts for such beliefs as we can reasonably expect to amend". Pólya recommends caution in changing our beliefs. Bucky's self-discipline was to "abandon completely all that I ever had been taught to believe". That is a big difference.

How ought we learn from experience? Should Bucky or Pólya be our guide for experiential learning?

Let's gain some perspective on this question by considering "everyday theory," principles that ordinary people invent to explain their worlds, in comparison to a theory from a scholarly tradition as discussed in this six minute video of Smitha Radhakrishnan and Patricia Hill Collins:

Patricia Hill Collins makes the poignant point that the everyday theories of ordinary people may be both not-quite-true and yet very empowering for living a human life. In seriously considering her point, I came to realize just how violent it is to disabuse someone of their not-quite-true coping mechanism just because I believe my theory is supported by better evidence or better scholarship or apodicticity (being incontrovertible). Focusing on the truth of our beliefs misses the more important operational view: identifying and appreciating the value of our beliefs as tools for living our lives, even when they are not-quite-true.

This insight from sociology powerfully reinforces an observation I made after studying "Advanced Introductory Classical Mechanics" with David E. Pritchard on MITx in 2016: so-called inferior theories like Newtonian mechanics are still essential for effective thinking in physics. Universities still teach these allegedly obsolete theories because effective learning requires both generalized and specialized tools to understand the world. Patricia Hill Collins, it seems to me, is arguing the same thing in the context of sociology.

> My definition of the word believe means to accept an explanation of physical phenomena without any experiential evidence. At the outset of my resolve not only to do my own thinking but to keep that thinking concerned only with directly experienced evidence, I resolved to abandon completely all that I ever had been taught to believe.
>
> —R. Buckminster Fuller, Critical Path

Now, how can we come to value Bucky's recommendation that we think "only with directly experienced evidence" despite Patricia Hill Collins' observation that not-quite-true beliefs can be more empowering and despite our realization from physics that so-called obsolete beliefs are still useful? Let's consider Bucky's quote again:

Bucky presents a self-discipline. It is not a manifesto, it is a suggestion to test the beliefs we have been taught with the inventory of experiential evidence we have accumulated. I hear Bucky saying: to think about the world more effectively than our received beliefs permit, you need to boldly question those beliefs. Bucky's unique way of seeing the world was probably forged from his willingness to abandon the beliefs he had been taught. If we are to to see the world in new ways, we too must be willing to abandon what we have been taught.

Bucky is not telling us to disabuse others of their beliefs. To remind us to refrain from zealously imposing Bucky's ideas on others, it is helpful to be reminded of his comment in the interview "Only Integrity is Going to Count" on February 26, 1983: "I never try to tell anybody else what to do".

Bucky is offering us the service of his self-discipline in the hope that some of us may find it helpful to rethink the world anew with fresh eyes. Maybe you are ready to abandon the beliefs that are blocking you from really doing your own thinking. In that case, Bucky's approach can be valuable.

But, as George Pólya reminds us, changing our beliefs can upset our emotional balance. Maybe, you prefer Pólya's inductive attitude because it invites us to learn from experience with less upset. Or, maybe, your apodictic (certain) beliefs are so strong that you would not change them no matter how strong the evidence.

Our inventory of experiences clearly includes contradictory advice about how to learn. From the comprehensive view, we would like to adopt values to guide us in learning from experience. Since our guidance is contradictory, each comprehensive explorer must take on the responsibility to design their own system of values.

How do you think you should learn from experience?

How should we learn from experience for our comprehensive practice? How might it change depending on our life history (the timing and events that comprise our lives such as age, number of children, grandchildren, etc.)?

18.3 The Ethics of Comprehensive Practice

Ethics is the system of values and principles about proper behavior a community develops to regulate its practice. As we try to imagine values to guide the proper conduct of comprehensive inquiry and action, we are effectively designing the ethics for our comprehensive practice. The ethical values recommended for a system of knowing are called epistemic virtues.

All traditions of inquiry and action share stories to perpetuate and regenerate their cultural system (see the resource The Fundamental Role of Story in Our Lives). All storytelling is fictive: it is a construction or invention imagined to communicate ideas and values. Storytelling is the imaginative repackaging of experiences in support of a tradition. Experience may be the unit of communication in our stories.

To further develop a process of imagining the epistemic virtues needed to properly learn from experience, we have explored the moral qualities that George Pólya and Buckminster Fuller included in their accounts of learning from experience. The proper epistemic virtues for comprehensive practice may vary from time-to-time, from place-to-place, or even at different moments in one's life history. To foster the kind of dynamic thinking needed to considerately develop your own ethical guidance, we leave it to each explorer to choose values to guide their own comprehensivity, their inclination for comprehensive exploration.

This essay was written to provide ideas in support of the 15 December 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 2h 13m video from the 15 December 2021 event:

19 Comprehensive Exploration, Comprehension, and Collaboration

06 January 2022 in Resource Center.

To better understand the kind of inquiry and action that might foster our comprehensivity, our aspiration to better understand it all and each other, we can examine alternative approaches. Comparisons between alternative approaches to learning may help us better imagine what might facilitate our comprehensivity. This resource reviews Ten Epistemic Virtues for comprehensive andragogy identified in a previous resource and then compares them to the Three Sisters Garden Metaphor for Learning of Barbara Wall and the Four Sets of Competencies for Learning from *The Design Way*.

Since this resource references the indigenous wisdom included in the Three Sisters Garden Metaphor (discussed below), it is appropriate to include a land acknowledgment: I write from Upper Darby, Pennsylvania which is part of the traditional territory of the Lenni-Lenape. I acknowledge the Lenni-Lenape as the original people of this land and their continuing relationship with their territory. I acknowledge the injustice of the state-sponsored genocide and settler colonialism that gave me the "right" to occupy this land without a meaningful reconciliation with the Lenni-Lenape. The governments of Australia and Canada have both organized commissions that have acknowledged the genocides on their territories and have made some attempts at reconciling with indigenous peoples. I regret that the government of the United States has not yet begun a meaningful process of reconciliation. Follow this link for some materials I organized documenting these genocides.

Footnote: Barbara Wall's eloquent four minute introduction and land acknowledgement exemplifies and contextualizes these comments:

19.1 10 Epistemic Virtues for Comprehensive Learning

In the resource Dante's Comedìa and Our Comprehensivity, a set of 10 Epistemic Virtues for Comprehensive Learning was presented. This schema for comprehensive andragogy ("andragogy" means the guidance of learning) is summarized in this short seven minute video:

We can organize these ten values into three categories, namely, *exploration*, *comprehension*, and *collaboration*, to better identify aspects of comprehensive practice:

All learning can be characterized as exploration. For instance, when learning by drill to reflexively act in specific ways, the space of possibilities we must explore and master is large enough that it takes many iterations to competently master any ritual. Comprehensive exploration refers to any learning that engages comprehensive values.

We have identified six virtues to guide our comprehensive explorations. We should aspire to adequate depth, breadth, and wholeness so that a survey of experiences, stories, hypotheses, and perspectives may provide an adequate basis for effective meaning making. In the resource The Whole Shebang, we learned from Jan Zwicky that our aha moments of insight (our experiences of meaning) may not reflect the truth. So, to complete an exploration we should attempt to identify gaps in our under-

standings, interpretations, communications, and intentions. Due to the possibility of unidentified gaps, no exploration can ever be be fully complete. However, we can obtain an adequately comprehensive understanding by (at least) briefly assessing and surveying the gaps to contextualize the meanings developed in our explorations. These first six epistemic virtues establish the ideal for comprehensive exploration in our proposed schema for comprehensive andragogy.

The next three levels in our schema (7, 8, and 9) all try to encompass our learning into formulations that offer structures for understanding the world and each other. Generalized principles are vetted abstractions that summarize broad swaths of our experience data. They represent a first-cut level of comprehensive comprehension. Such principles and abstractions can and should be put together into an integrated whole system, an *integrity*, to provide a contextualized system for understanding the world. Many of the all-encompassing theories that have been developed, such as quantum electrodynamics (QED) qualify as an integrity in our schema.

There may be other levels of structured big picture understandings like generalized principles and integrities. I propose that we define the highest level of *comprehensive comprehension* as the broadest, deepest, and most integrated form of question-structured story we can muster to provide a comprehensively nuanced interpretative integrity in support of our judgment. That is, the highest objective for our comprehensive learning is to support our facility for effective judgment-making.

Since it is impossible to know a priori the kind of comprehensive comprehensions suitable for the best judgment-making, the best we can do is try our best and reflect upon the results. Then iterate and try some more. Comprehensive comprehension is an ideal. As we practice striving for it, our understanding may clarify and we may learn how to routinely build comprehensive comprehensions at various levels.

Comprehensive collaboration, level 10 in our schema, can be engaged at all levels of comprehensive practice. Comprehensive collaboration is the recognition that all our learning is encompassed by our social fabric. The ideas of other people are essential to help us adequately test our meaning making with other experiences, stories, hypotheses, perspectives, and gap-seeing mistake mystique. No one working on their own can possibly identify enough considerations to fully complete a comprehensive exploration, let alone a comprehensive comprehension. We need the support of a com-

munity of fellow explorers. This collaborative character of comprehensive practice is essential. Even the most comprehensive exploration or comprehension that any one person can organize should be considered incomplete until an adequate engagement with collaborators tests and strengthens its ideas.

Hopefully, this 10 Virtues schema for comprehensive learning helps us better guide our comprehensive initiative-taking. There is no reason to believe that this schema is the best possible guidance for fostering our comprehensivity. Most likely we will gradually discover even better ways to guide our comprehensive learning. The schema is offered as a starting point to begin developing our tradition of comprehensive practice.

What do you like about the Ten Virtues schema for comprehensive learning?

What strengths and shortcomings do you find in the 10 Virtues approach to fostering our comprehensivity?

19.2 The Three Sisters Garden Metaphor of Barbara Wall

To further examine the 10 Virtues model, to "kick its tires" so to speak, we might compare it to the Three Sisters Garden Metaphor of Barbara Wall as described in this seven minute clip from one of the Buckminster Fuller Institute's Space Camp educational programs:

Barbara Wall's Three Sisters schema of learning sees corn as the scaffold of knowledge (philosophy) with beans representing scientific knowledge offering nutriment guided by corn for structural support. Squash (the third sister) represents the ethical space for intellectual pluralism to support a full ecosystem in reconciliation with spiritual knowledge grounded in squash's role as moisture and weed control. The symbiosis of corn, beans, and squash represents a fully engaged ecosystem of the mind articulating a reconciled pluralism for the nourishment of the community.

To test the Three Sisters schema I tried to fit it into the Real/True/Ideal schema from *The Design Way* by Harold Nelson and Erik Stolterman. My first attempt was to imagine corn as The Ideal, beans as The True, and squash as The Real. I'm neither comfortable with the scaffold for knowledge as The Ideal nor am I comfortable with the spiritual

engaged at the level of The Real as the domain of ethics. Maybe swapping my mapping so that corn represents The Real and squash represents The Ideal works better? Maybe corn should represent The Real? Maybe the Three Sisters only imperfectly aligns with the Real/True/Ideal trichotomy?

How does the Three Sisters compare to the 10 Values schema?

I like the way the Three Sisters aim us toward comprehensive comprehension as a reconciliation. I love the way the Three Sisters metaphor invites a responsible pluralism in its emphases on diversity and reconciliation. I especially value how the Three Sisters identifies the lack of explicit inclusion of spiritual knowledge in the 10 Virtues schema (spirituality is included as experiences, stories, and perspectives, but it is a deficiency that, so far, no discussion of spiritual knowledge has been offered). I value how the Three Sisters metaphor emphasizes respect for human and non-human agents. Finally, I especially value the strong collaborative pull of symbiosis and reconciliation in the Three Sisters.

How would you compare the Three Sisters schema for learning with the 10 Virtues? How can the Three Sisters help us strengthen the 10 Virtues?

19.3 The Four Sets Schema in The Design Way

The Four Sets of Competencies for Learning schema is presented in *The Design Way* by Harold G. Nelson and Erik Stolterman (see pages 229–230 and Figures 14.12–14.17) [NS12]. The Four Sets are the four quadrants formed by a horizontal axis ranging from the "Internal / Individual / Personal" to the "External / Social-Collective / Organizational" and a vertical axis ranging from the "Abstract / General / Theoretical, Strategic" to the "Concrete / Particular / Tactical, Applied". In the four quadrants between the axes, we have the Abstract-Internal Mindset where our character lives, the Abstract-External Knowledge Set for our thinking, the Concrete-External Toolset for acting in the world, and the Concrete-Internal Skillset that informs our practice.

The 10 Virtues schema divides comprehensive practice into exploration, comprehension, and collaboration. The Three Sisters metaphor provides a supportive alternative model for comprehensive learning. But how is the Four Sets schema to be integrated?

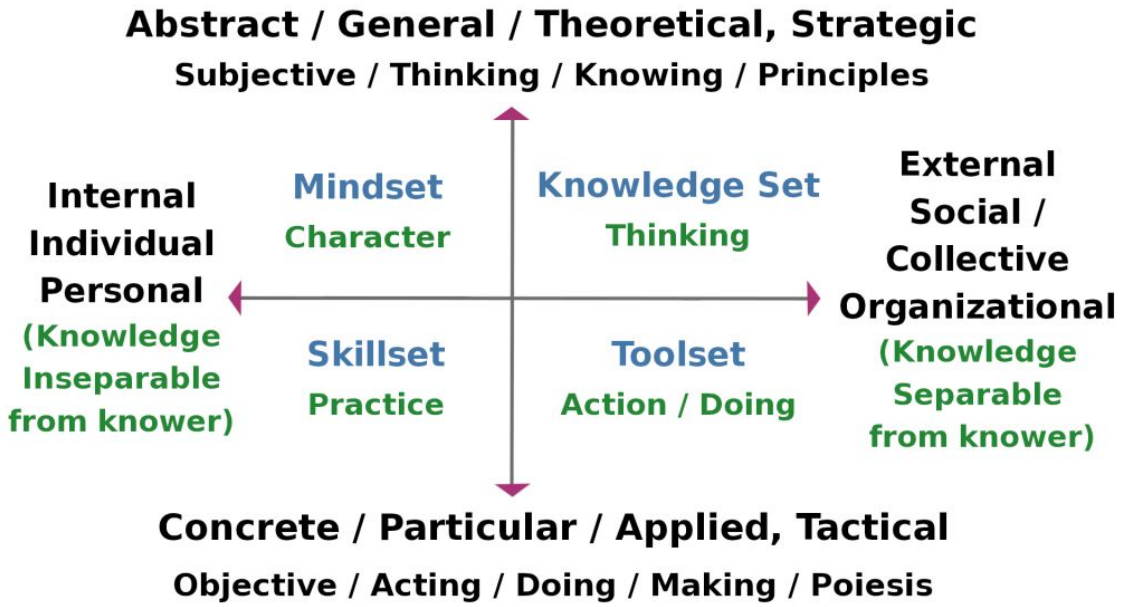


Figure 19.1: The Four Sets of Competencies for Learning Schema (adapted from *The Design Way*)

The Four Sets schema provides a model for human learning in any tradition. All learning makes the distinction between the abstract subjective and the concrete objective, between ideas that summarize and integrate large collections of experience data and the objective particulars that are abstracted. And all human learning is articulated by individuals in the context of their social milieu. The Four Sets schema starts with these two distinctions as independent axes and then defines the interstitial quadrants that lie between them as Mindsets, Knowledge Sets, Toolsets, and Skillsets. It is a general schema characterizing any human learning.

We can apply the Four Sets schema to our comprehensive practice by tuning in to its four competencies in each of our explorations, comprehensions, or collaborations. That is, we can strengthen our inquiry and action by including each of its four competency sets in our exploration. In addition, since the schema applies to every tradition that we are integrating, it can help us more fully examine these other traditions: have we looked for the character, practice, and tools, as well as the knowledge sets used in each tradition? Moreover, as we reflect on our emerging comprehensive collaborations, we might ask if we have considered and integrated the mindsets, skillsets, toolsets, and knowledge sets of our collaborative participants?

Another application would take each of our 10 Virtues for comprehensive learning and ask what knowledge sets, toolsets, skillsets, and mindsets can help us better articulate that value? For example, for the third virtue of “Experiences / Stories”, we can think about the knowledge sets of empiricism, story-telling, observation, interpretation, etc. We might then wonder about the concrete toolsets and skillsets that might foster our ability to tune into the relevant experiences and communicate them to our collaborators. Finally, we might reflect on the mindsets and character we will need to better organize our inventory of experience for our comprehensive learning. Similar analyses considering how each of the 10 epistemic virtues is connected to each of the four competencies might be illuminating.

Finally, we might apply the Four Sets schema to the practice of our comprehensivity itself. So, we might try to identify and situate the mindsets, skillsets, toolsets, and knowledge sets that are needed for effective comprehensive practice. This might help us develop and test alternative schemas for the practice of our comprehensivity.

What relationships and connections among the 10 Virtues, 3 Sisters, and 4 Sets do you think might better articulate our comprehensive practice?

If you were a steward for our tradition of comprehensive learning, how would you pass on to others the nature of our practice? Which aspects of the 10 Virtues, 3 Sisters, and 4 Sets would you use, if any? What schema of learning would you recommend to students of comprehensive inquiry and action?

19.4 Developing Our Comprehensive Practice

Comprehensive practice, as we have been considering it, consists of exploration, integrative comprehension, and collaboration. To better articulate these three aspects of our emerging tradition, we examined a 10 Epistemic Virtues schema for guiding our practice. To further explore how we might articulate our practice we compared it with Barbara Wall's Three Sisters Garden Metaphor for Learning. Finally, we re-considered our practice and our values in comparison with the Four Sets of Competencies for Learning schema from *The Design Way*.

Hopefully, we now see better how to explore, comprehend, and collaborate comprehensively. We have made some progress developing our thinking about the nature of comprehensive practice. However, the various partially overlapping ranges of epistemic virtues, vegetable garden metaphors, and competency categories remind us of Robert Sapolsky's dangers of categorical thinking: 1) we can miss the big picture by focusing on boundaries, 2) we tend to underestimate differences when two cases happen to fall in the same category, 3) we tend to overestimate differences when cases happen to fall on opposite sides of a boundary. Considering each distinction, each category in the 10 Virtues, 3 Sisters, and 4 Sets schemas can lead us to the blindspots and distortions identified by Sapolsky's list of dangers.

Sapolsky observed that all thinking is built on distinctions. Distinctions introduce categories that can distract from the big picture and distort our thinking about the particulars. Distinctions are fraught with epistemic dangers. Some of us saw how Dante struggled to use distinctions to gesture toward the unity of God. Thinking and exploration depends on distinctions, yet these very distinctions warp our understanding. It is one of the most profound paradoxes of life and of learning. It is the reason developing our mistake mystique is so important.

These reflections suggest we should treat each schema as a helpful guide that might prove useful even though each is sure to include blindspots and other evils. A bold humility is required: the boldness to believe in our ideas and to develop them even though they are filled with potentially troublesome distinctions combined with the humility that recognizes that gaps, blindspots, and other dangers will challenge us. Comparing multiple schemas provides the tool of overlapping sets of alternative distinctions to help us understand more deeply, more broadly, and more integratively. It will require creative, dynamic application to use these schemas and their comparisons to benefit from their power together with caution to avoid their pitfalls.

This essay was written to provide ideas in support of the 12 January 2022 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society.

Addendum: 1h 46m video from the 12 January 2022 event:

20 Tools for Comprehensivity: Ambiguity, Contradiction, and Paradox

10 February 2022 in Resource Center.

Comprehensive learning aspires to integrate more and more of Humanity's traditions of learning to better comprehend the world and how it works. As we learn more and more from these diverse ways of knowing, it becomes increasingly likely that the perspectives, hypotheses, and frames of reference we encounter will seem incompatible or even inconsistent with others. This resource suggests how to better accommodate these ambiguities as tools for our comprehensive practice.

This way of accommodating ambiguity in our learning is a central theme in the profound 2007 book "How Mathematicians Think: Using Ambiguity, Contradiction, and Paradox to Create Mathematics" by William Byers. The book examines ambiguity while it surveys the folklore of mathematics culture and the philosophy of mathematics. It is easy to read and serves as a good introduction to mathematics for readers with weak math skills. It might be especially valuable for those wanting to expand the compass of their comprehensive learning with mathematics.

20.1 Ambiguity, Contradiction, and Paradox

In the book "How Mathematicians Think", William Byers argues that the power of mathematical ideas comes from their ambiguity. Let's start with his definition of ambiguity:

> Ambiguity involves a single situation or idea that is perceived in two self-consistent but mutually incompatible frames of reference.
>
> —William Byers in ``How Mathematicians Think'', p. 28.

Byers discusses how equations like "$2 + 3 = 5$" contain two separate frames of reference. On the left hand side "$2 + 3$" is a process, a verb, the addition of 3 to 2, an arithmetic combining of two numbers. On the right hand side is the number 5. Processes as verbs are different from objects as nouns. This seems to be a category error worse than combining apples and oranges. Yet, the equation, as we all know, is true. What are we to make of this? Does arithmetic reconcile ambiguous category errors?

Byers also looks at variables in algebraic equations such as $3x + 2 = 8$. Does the 'x' refer to any number, is it a variable that varies over all possibilities, or does it refer to the number 2? Byers explains: "the answer is both and neither. At the beginning x could be anything. At the end, x can only be 2". Variables in mathematical discourse always entail this ambiguous status where they are general and specific depending on our frame of reference. My Synergetics colleague Tom Miller calls such situations the "both/neither" where two perspectives, hypotheses, or frames of reference are both true and, at the same time, each is not true. The both/neither is a kind of ambiguity.

Byers gives many more examples. He concludes:

> The control in mathematics is provided by the logical structure, and the power and profundity of mathematics is a consequence of having deep ambiguity under the strictest logical control...The ambiguity is `resolved' by the creation of a larger meaning that contains the original meanings and reduces to them in special cases. This process requires a creative act of understanding or insight.
>
> —William Byers in ``How Mathematicians Think'', p. 77--8.

Is ambiguity at the heart of our understanding?

Contradictions are almost the same as ambiguities. The difference is that in contradictions the two "mutually incompatible frames of reference" cannot be resolved into a single situation or idea that is consistent. The two frames conflict so incompatibly that we call it inconsistent.

Byers' favorite example of the power of contradictories in mathematics is zero. Byers characterizes zero with the title of Robert Kaplan's 1999 book "The Nothing That Is". The nothing that is is an apt description of zero's inherently contradictory nature. How can we represent nothing? For students of mathematics, the task is

simple: represent it with the word “zero” and the symbol “0”. We say that zero is a number, a definite object. But this object represents nothing! How can that be? Can we honestly say that the number zero is nothing? Byers writes, “Does ‘nothing’ exist, and if not how can we talk of it? ...zero is a name for something that does not exist.”

The concept of zero was a crucial advance in the history of mathematics. Yet it seems inherently contradictory. Byers observes, “far from excising the contradiction from our thought, we have learned to use it in a constructive and creative manner.” He adds, that from zero “a concept that is inherently contradictory has been made ambiguous by creating out of zero ‘a single idea’.” Zero is the single idea of a number that stands for nothingness. We boldly ignore the inherent contradiction at the heart of the idea except, of course, when we divide by zero which is strictly verboten.

Byers adds, “Both coherence and contradiction are fundamental components of ambiguity.” The “both/neither” captures this principle by highlighting coherence (the both) and contradiction (the neither). Both/neither contrasts with both/and in our culture’s current zeitgeist. Both/neither is the logic of ambiguity. If ambiguity is as fundamental as Byers argues, then both/neither logic is more important than the both/and logic that many of us have been using.

Are contradictions essential to the both/neither logic of ambiguity?

Byers quotes the Encarta World English Dictionary for a definition of paradox: “a paradox ‘is a situation or proposition that seems to be absurd or contradictory but is or may be true.'” In contradiction, we know that the two frames of reference are inherently inconsistent. In paradox, there is a possibility of reconciliation, of resolving the absurdity. Byers writes,

> Paradox is not something alien to life; it is the basic fabric out of which life is composed.
>
> —William Byers in ``How Mathematicians Think'', p. 112.

Is “zero” merely paradoxical or inherently contradictory? I think it depends on your spiritual beliefs about logic: if your spirituality of logic rejects contradictions, then to keep zero you would consider zero merely paradoxical. But if your spirituality tolerates truths in contradictions, you might prefer to call a spade a spade and say that “zero” is contradictory. Here is how Byers addresses this concern:

> ``zero'' is paradoxical---it contains a contradictory aspect and yet [it] is a fundamental mathematical concept.
>
> —William Byers in ``How Mathematicians Think'', p. 113.

Does this suggest that if an idea is contradictory but sufficiently useful, we should set aside its contradictoriness so we can access the idea's creative power? Does that also suggest that our culture's overemphasis on the so-called law of noncontradiction which prohibits contradictions is misplaced?

Byers' book goes on to explore the paradoxes of infinity in depth. He explains that contradictions and paradoxes are two aspects of ambiguity. So ambiguity, in all its manifestations, can be seen as the crucial idea.

> Logic moves in ... the direction of clarity, coherence, and structure. Ambiguity moves in the other direction, that of fluidity, openness, and release. Mathematics moves back and forth between these two poles.
>
> —William Byers in ``How Mathematicians Think'', p. 77--8.

Byers' schema for ambiguity in learning accommodates these two poles or phases. The contracting or converging phase brings clarity, coherence, and structure by learning in depth. The expanding or diverging phase brings fluidity, openness, and release by learning in breadth. Control and logic work to make the system cohere in a meaningful structure, it focuses, contracts, and converges to produce depth. Learning in breadth with its context confronts us with ambiguities and their incompatible stories or data and frames of reference challenging our ability to find resonant wholes for meaning making as we diverge and expand our perspective.

Do ambiguities including contradictions and paradoxes organize and drive our learning as we navigate the essential poles of depth and breadth?

20.2 Ideas, Great Ideas, and Truth

In the second section of his book, Byers builds on the above foundation of ambiguity to explore the nature and truth of ideas.

> The creative in mathematics is expressed through the birth of new ideas. These ideas may consist of a new way of thinking about a familiar concept or they may involve the development of an entirely novel concept.

—William Byers in ``How Mathematicians Think'', p. 191.

These quotes summarize Byers' thinking about how ambiguity leads to ideas:

> An idea emerges in response to the tension that results from the conflict inherent in ambiguity.... An idea is a principle that organizes experience.... [It] is an answer to the question, ``What is going on here?'' ... The ambiguity does not limit the idea---the ambiguity is the very thing that flowers into the idea.
>
> —William Byers in ``How Mathematicians Think'', p. 191--203.

Byers asserts "great ideas come out of situations of great ambiguity". He then develops the great idea of "one":

> ``One'' is an idea that goes beyond mathematics. As was the case with ``zero'' and ``nothing,'' the mathematical ``one'' is an idea that grows out of the human condition itself.... [N]otice that ``one'' and the connected idea of ``oneness'' are ambiguous, that is, they are used in two different and conflicting senses. In the first sense, ``one'' represents something that is a unit and distinct from all others---a unique individual in a world of other individuals. The second sense comes from the word ``oneness'' or ``to be one with,'' which means connected or part of a larger whole.... The first sense emphasizes the uniqueness and separateness of that which is designated as the ``one,'' the second the harmonious integration of parts.
>
> —William Byers in ``How Mathematicians Think'', p. 205--206.

Byers gives many examples of ideas in mathematics. He explores how "the idea is always wrong". This reminds me of Jan Zwicky's realization that our meaning making insights may not be true as we explored in the resource The Whole Shebang. It is the reason we have emphasized mistake mystique in several previous resources (see the resources Mistake Mystique in Learning and in Life and Redressing The Crises of Ignorance). It is also a reminder of the both/neither logic where the coexistence of coherence and contradiction are an inherent aspect of ambiguity. The both/neither logic is inherent in ideas too.

Byers summarizes:

> We are beginning to see paradox, not as something to be avoided and eliminated, but as a potentially rich source of ideas.

—William Byers in ``How Mathematicians Think'', p. 283.

Byers motivates an exploration of great ideas with a Simone Weil quote:

> All true good carries with it conditions which are contradictory and as a consequence impossible. He who keeps his attention really fixed on this impossibility and acts will do what is good. In the same way all truth contains a contradiction.
>
> —Simone Weil as quoted in ``How Mathematicians Think'', p. 284.

Byers adapts her quote to say, "a great idea carries with it conditions which are contradictory and as a consequence impossible." He emphasizes that "a 'great idea' begins with a gap—a gap that seems unbridgeable." Logic then helps us formulate and organize the idea. Nonetheless, there are always limitations, some of the falseness remains. Byers clarifies, "it is not the idea so much as the universality of the idea that is false.... Great ideas are wrong but they are wrong in a brilliant and inspired way."

I hear Byers characterizing truth as the insight of creative immediate certainty when the light is turned on. This seems analogous to "the experience of meaning" of Jan Zwicky in forming gestalt wholes (see the resource The Whole Shebang). Byers says "the truth cannot be completely objectified; it is not completely 'out there'". Truth is a kind of objective subjectivity or a subjective objectivity. It cannot be completely formalized or captured. It is like a rainbow: it is objective, but we can never find the end of the rainbow because it is not an object. The truth is the coherence of a great idea together with its falseness, its contradiction, its ambiguity, its inherent both/neither logic.

Does Byers' thinking about ideas, great ideas, and truths as inherently ambiguous help us better understand how we learn?

20.3 Ambiguity and Comprehensive Learning

What will we get if we incorporate William Byers' thinking about the central role of ambiguity in ideas, truths, and learning in our developing story about comprehensive learning?

Comprehensive learning involves studying more and more sources from more and more of Humanity's great traditions of inquiry and action. These explorations inevitably lead to expanding the number of potentially incompatible hypotheses, perspectives, and frames of reference that we consider. As a result we are sure to confront ambiguities. Byers' approach sees these ambiguities as tools to help us organize our learning.

With Byers' insights, we can appreciate the ambiguity between breadth and depth as the two poles of comprehensive learning. Breadth is the diverging, expanding, and contextualizing phase. Depth is the converging, contracting, and clarifying phase. Now, perhaps, we can better judge how to keep breadth and depth in balance in our learning.

Inspired by how mathematics has profitably organized the numbers one and zero, arithmetic equations, and algebra as powerful ideas, we too may apply various logics to see if we can ferret out ideas that integrate the different frames of reference and perspectives that we are studying. Even if we succeed, we know, from the examples of mathematics, that inevitably some ambiguity will remain to spur tomorrow's learning efforts.

Byers' discussion on seeing the light in the context of ambiguity may help us better understand the adequate wholeness we value for meaning making. We may now realize that our experiences of meaning, as Jan Zwicky calls them, inherently involve ambiguity, paradox, and even contradiction.

Byers' insights reinforce our value of mistake mystique where we valorize looking for and identifying the gaps in our understandings, communications, and designs. Indeed inherent ambiguity explains why there must be such gaps! It also explains why the logic of the both/neither can help us better find the ambiguities in our ideas, principles, and truths to spur us to deeper thinking.

Ambiguity with its both/neither logic can also help us organize comprehensive comprehensions (see the resource Comprehensive Exploration, Comprehension, and Collaboration), our most integrated forms of knowing. Ambiguities naturally suggest questions that characterize what we do not understand, our ignorance. Our value for a thoroughly refined ignorance aspires toward a question structured survey of our learning (thoroughly refined ignorance was introduced in the resource Shifting

Perspectives and Representing The Truth). This refined ignorance can now be seen as an outline of the ambiguities we have identified. If this way of integrating our knowledge facilitates effective judgment making, we will have understood the incisive aspects of our situation.

William Byers shows us that embracing ambiguity, contradiction, and paradox can reward us with access to the creative wellspring of great ideas and truths! As we try to integrate more and more of humanity's traditions of inquiry and action we should consider engaging the ambiguities we may have shied away from previously.

How has a survey of William Byers' thinking about learning in mathematics improved your understanding of comprehensive learning?

This essay was written to provide ideas in support of the 16 February 2022 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society.

Addendum: 1h 41m video from the 16 February 2022 event:

21 Articulating Comprehensivity: The Comprehensive Design of Our Lives

10 March 2022 in Resource Center.

To better understand how we might practice our comprehensivity, our aspiration for comprehensive thinking and doing, we might examine how to clarify or make effective such desires. This resource attempts to imagine how we might practice our comprehensivity. In the end we might apprehend how we can articulate the comprehensive design of our lives.

21.1 Articulating Comprehensivity

According to Wiktionary, to articulate is "to make clear or effective". Comprehensivity is our inclination to understand it all and each other. So by *articulating comprehensivity* we mean making our aspiration to understand it all and each other more effective and clearer. How can we better clarify and make more effective our efforts to build an ever more extensive, ever more intensive, and ever more integrated understanding of our worlds and its peoples? How can we better articulate our comprehensivity?

In the resource Humanity's Great Traditions of Inquiry and Action, several possibilities were outlined. One was to let our life's missions and objectives guide our comprehensive inquiry and action. Another was to pursue our current projects, interests, and desires as the guide for our comprehensivity. Alternatively, we could give a significant stretch to our perspective by exploring a new tradition outside our comfort zone. Or, we could explore one of the universalist traditions including synergetics, cybernetics, systemics, complexity, semiotics, cultural studies, world-systems theory, integral theory, wholism, consilience, mathesis universalis, universology,

transdisciplinarity, pansophism, the liberal arts, Renaissance humanism, science and technology, or any of the mythological, mystical, magical, religious, or spiritual traditions. Finally, we could choose a randomly selected new tradition to guide our next phase of comprehensive inquiry and action.

How else might we articulate our comprehensivity?

One helpful model comes from observing children. Children are presented with behaviors, ideas, values, and artifacts from their culture by close relations and their network of child-care providers. Children learn the local dialect of a language, or perhaps several dialects from one or more language families. They are introduced to many traditions such as music, biking, games, sports, schooling, etc. As youths, we practice or play with these traditions. Some of them strike our fancy so we play with them more and start learning in depth. Sometimes we learn by observing. In general, we play with our cultural heritage as mediated through our close relations and child-care provider networks.

Gradually, we learn quite a lot about a lot of the different traditions that are important to our society. Over the course of many years we integrate all these experiences into our understanding of the world and how it works.

In this sense articulating our comprehensivity is trivial: each of us has spontaneously coordinated our comprehensivity from birth by engaging the sampling of our society's cultural traditions that we were exposed to. As we become adults many of us narrow our focus to just a few traditions, just a few sources of new information, just a few spaces where we interact with people practicing different traditions. The broadly attentive comprehensivity that we developed in childhood becomes the well-defined but narrowly scoped comprehensivity of the identities and roles we assume as adults.

Through this ad hoc, subjective comprehensivity we become adults. Nevertheless, our worlds are so complex that the set of traditions learned in this ad hoc fashion often results in feelings of fragmentation, disorderliness, and incomprehensibility.

Can our dawning understanding of comprehensive thinking and doing suggest other ways to articulate our comprehensivity?

In the resource on Ambiguity, Contradiction, and Paradox, we learned that comprehensive learning alternates between breadth as the diverging, expanding, and contextualizing phase and depth as the converging, focusing, and clarifying phase. This realization can help us better navigate our explorations by wondering which traditions might provide us with useful context and which might better clarify what is going on in our situation.

Observe that even when converging in depth, it is necessary to be aware of the breadth of the scope of the relations we have under consideration. And when diverging we need enough clarity, specifics, and depth to assess the context we are scoping. In this way we may come to realize that all learning involves a complex intertwining of breadth and depth as we think through the stories, experiences, conceptualities, and behaviors that form the bases for any tradition. By asking whether we have an adequate breadth to contextualize our exploration and whether we have adequate focus on and clarity of the systems we are considering, we can tune the breadth and depth in our learning and thereby better articulate our comprehensivity.

How can the awareness of breadth as divergence for context and depth as convergence for clarity help us better articulate our comprehensivity?

In the resource on Chronofiles, we examined Buckminster Fuller's practice of documenting in a largely chronological archive the news, reports, ideas, and artifacts that might inform our future comprehensive practice. By curating written and material culture, we organize the knowledge that seems most significant to us for better understanding the world. These reminders of stories, experiences, and traditions can help us find patterns, interrelationships, and ideas that might otherwise be too faint in our memories for formulating insights about how our worlds work. As such a chronofile of personal research records and curated artifacts is a powerful way to articulate our comprehensivity.

How might you better curate your written and material archives to better articulate your comprehensivity?

How else might we articulate our comprehensivity?

21.2 Initiative-Taking, Profession, Mission, and Vision

In general, we might think of our lives as a series of initiative-takings. All inquiry and all action can be conceived of as initiative-taking. To articulate our comprehensivity as initiative-taking, we might view some initiatives in our past as expanding or diverging for breadth while others might be viewed as converging or clarifying for depth. Looking forward, we might assess whether our next initiative should focus more on expanding our breadth to gather more context or whether our attention should focus more on an in depth examination to clarify one or more of the systems we are presently concerned with.

The society-directed approach to the learning of childhood guided the comprehensive articulation of our youth. As we gather experience, we organize memories, and better yet, chronofiles with their curated records and artifacts. Our accumulated experience with our archives-enhanced memory can help us reflect on what our next initiative might be and how we might approach it.

We might inquire as to how we best learn. We might examine our patterns of mistake-making. We could work at strengthening our skills in those traditions where we are weak. We may wonder what records and artifacts would help us better select future initiatives for the development of our lives? We could ask whether the conditioned reflexes, preferred conceptualities, behaviors, and beliefs that we have developed might sometimes contradict our other ideas, values, and desires. We could undertake a broad assessment of the accumulated knowledge of our lives. We might find that the accumulated knowledge in our inventory of traditions beckons us toward a particular next initiative.

How can we guide our initiative-taking to better articulate our comprehensivity?

Alternatively, we might choose one of the traditions that interests us and dedicate ourselves to guiding our initiatives using its approach. In this way we might choose a profession, identity, or calling, where we focus on this chosen art. With our current culture's preoccupation with identity and career, it is likely that many of you have adopted this "choose one" approach for guiding your lives.

Those familiar with the business and non-profit traditions may choose to guide their lives by committing to a mission or with the even more inspirational approach of dedicating oneself to a vision. It seems to me that all these approaches, even the declaration of a life mission or vision, amounts to the choosing of one tradition to be your life guide. Yes, your choice might fuse many other traditions in an enterprising interdisciplinary synthesis or it might even scope out a new space between the already existing traditions. That is, it might be very broad or enterprising.

But the choice of a profession, career, trade, art, identity, calling, mission, or vision is just one tradition among many. Its scope is inherently limiting. When we limit ourselves to any one tradition, even if it is a tradition that broadly incorporates many others, we may lose interest in and might not seek out the full scope of possibilities for being human, we might not look for alternative ways of interpreting and understanding our worlds and each other, we might miss many options, many possibilities.

Nevertheless, choosing a tradition to be our guide in life may be a strength. Some people in some situations at some times in history should adopt a focused but limited guide for their lives. Even if your situation doesn't "demand" a limited profession, there is a magic in the focus on a single tradition around which to rally one's full attention. There should be no shame in choosing to strive for something more limited than the broadest comprehensivity imaginable. Such a choice still articulates one's comprehensivity. It will have some breadth and some depth. It will partake of many of the epistemic virtues we have identified for comprehensivity (see the resource Comprehensive Exploration, Comprehension, and Collaboration). Such a limited profession might be one's unique contribution to civilization, it might be very special.

However, in its broadest scope, the aspiration of our comprehensivity is to understand the world and each other. There is no way to guarantee that any chosen profession is the One true way. No tradition can guarantee our destiny. In order to survey the full range of alternative traditions of inquiry and action, in order to understand the vast majority of Earth's billions, a comprehensively oriented explorer will need to engage, at least periodically, a program for learning that goes beyond whatever limits we may impose upon ourselves by vision, mission, profession, calling, identity, career, trade, or art.

While any choice we make for guiding our lives is a way of articulating our comprehensivity, it seems to me that we fail to fully articulate our comprehensivity unless we commit to continually diverging, expanding, and stretching to learn new traditions to further encompass our ability to understand it all and each other. We may be so committed to our profession that we only make time for going beyond its limits once a week, or once a month, or once a year, or once every time we have a mid-life crisis, but in order to articulate the broadest comprehensivity imaginable we must pay some attention to diverging beyond the limits of the traditions that we have chosen to profess.

How should we articulate or clarify and make effective our comprehensivity, our aspiration to understand our worlds and each other?

21.3 The Comprehensive Design of Our Lives

We have explored many ways in which we might articulate our comprehensivity. We looked at the ad hoc approach that our society subjectively imposes upon us as children. We looked at navigating our comprehensivity through regulating our diverging for context and our converging for clarity. We looked at how our memory supplemented with our curated chronofile archives of documents and artifacts can inform our initiative-taking. We looked at how our calling, vision, mission, or profession articulates our comprehensivity even though it generally limits our scope. We acknowledged that many people will benefit from such a limited comprehensivity.

However, it could be that what is most missing in our civilization is a conscientious effort to apprehend the astounding complexity of the whole world. Think of it: a civilization of nearly 8 billion people with access to some 7000 languages in nearly two hundred nations where we barely understand our neighbors let alone the peoples of Nauru or The Gambia. Our interconnected global communication, transportation, and socio-political-economy combined with widespread blindness of the nature and scope of humanity's large inventory of traditions leads many of us to feelings of fragmentation, disorderliness, and incomprehensibility.

Unless we strive to understand the world more broadly, how can we expect to secure our knowledge by testing it against the approaches of other traditions?

Unless we strive to understand the world more broadly, how can we expect to form a more effective understanding of the ways of the world and its peoples?

Our comprehensivity first comes to us through the ad hoc and subjective learning we receive as children. As our memories and our chronofile archives fill with knowledge about various traditions of inquiry and action, we gradually acquire the ability to intentionally and objectively shape our comprehensivity by choosing our next diverging or converging learning initiative from the inventory of possibilities. This then is the next step in articulating our comprehensivity: intentionally designing our learning journey by composing step-by-step an exploratory path through the traditions of inquiry and action that we think might prepare us to create a more desirable future. In this way, we design our comprehensivity.

[The language of design and futures was introduced in the resources How to Create That-Which-Is-Not-Yet and How To Explore The Future (and Why).]

By objectively designing our comprehensivity and reflecting on our practice as comprehensive explorers, comprehensive integrators, and comprehensive collaborators, we shape our future. Since the traditions we learn provide us with our capabilities for inquiry and action which, in turn, provide us with a large part of our effectiveness in life, we might come to the dawning realization that the design of our comprehensivity is essentially the design of our lives.

Readers of the profound book *The Design Way* by Harold G. Nelson and Erik Stolterman, will learn that the first step in any effort to create a new reality is to design the design. That is, to map out an approach to the possible contexts and directions that may help us realize our intention to create the not-yet-existing reality that we desire.

We can profess one of the traditions we have learned about and make it the guide and the designer for our life. Alternatively, we can intentionally choose to explore a complex of traditions, some in breadth, others in depth, to try to forge a comprehensivity that we think might best suit our character and aspirations. Either way, designing our comprehensivity is an important way in which we design the design of our lives.

How will you design your comprehensivity? How will those choices affect the way you come to understand the world and its peoples? How will that affect the design of your life?

Our comprehensivity and its articulation might represent the most important design choice of our lives.

This essay was written to provide ideas in support of the 16 March 2022 session of “Comprehensivist Wednesdays” at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society.

Addendum: 1h 29m video from the 16 March 2022 event:

22 What Is Comprehensive Learning?

21 June 2022 in Resource Center.

This resource attempts to recapitulate and situate comprehensive learning in the broad context of our learning and our lives. It compares comprehensive learning, an emerging tradition of inquiry and action, with other approaches to learning to further clarify its approach. It is a refinement of the notes I wrote two months ago to guide my remarks at the 13 April 2021 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society.

22.1 How does comprehensive learning compare to other ways of learning?

Buckminster Fuller wrote, "I am certain that none of the world's problems ... have any hope of solution except through all of world around society's individuals becoming thoroughly and comprehensively self-educated." The sentiment of this quote and related ones in Bucky's 1969 book "Operating Manual for Spaceship Earth" inspired me in 2019 to formulate the Collaborating for Comprehensivism initiative and led to the resource on The Comprehensive Thinking of R. Buckminster Fuller.

For me, the idea of comprehensive learning and its cognate comprehensive thinking begins with these ideas of Buckminster Fuller. I have been working to capture Bucky's ideas of comprehensive learning and abstract them into a new tradition of inquiry and action that does not require us to become Synergists in the style of Buckminster Fuller. That is, I imagine comprehensive learning to be broader in scope than even Bucky.

When Bucky defines Universe as "the aggregate of all of humanity's consciously-apprehended and communicated experience" and then recommends starting all inquiry with Universe and subdividing, he is effectively starting with Humanity's great inventory of all the traditions of inquiry and action in our cultural heritage. The

source of all our learning can be seen as coming from the whole of Humanity's cultural heritage. In contrast, we often think of our learning as coming from the three Rs, or from the classics, or the Great Books, or from standardized curricula. But that leaves out so much of Bucky's Universe and of our cultural heritage including the wisdom of indigenous peoples, folk traditions, and so much more.

My challenge has been to abstract Bucky's ideas about comprehensive learning and combine them with what I have learned from other traditions to precipitate the practice of a new conscientious tradition of inquiry and action to understand the world and each other which I call "Collaborating for Comprehensivism". At various times I have called it comprehensive practice, comprehensive understanding, the art of our comprehensivity, and various other attempts to find words to catalyze an emerging tradition based on Bucky's ideas. All with the goal of imagining comprehensive learning without undue restrictions to Bucky's or my own peculiar set of preferred ideas, inquiries, and actions.

I often start discussions on comprehensive learning with the characterization that it is about working to understand it all and each other. Physics is about understanding how the material world changes, biology is about understanding the nature of life, sociology is about how societies work, dance is about our traditions of movement, music is about traditions to put together sounds. Of all our traditions of inquiry and action, comprehensive learning is the only one that dares to embrace it all and then works toward understanding it all and each other by daring to consider the entirety of Humanity's cultural heritage.

There is a category of traditions which I have called *universalist* that claim to understand it all (see tagged resources on universalism). Bucky marketed his tradition of thinking as Synergetics. Other purportedly universalist traditions include cybernetics, systemics, complexity, semiotics, cultural studies, world-systems theory, integral theory, wholism, mathesis universalis, pansophism, the liberal arts, science and technology, or any of the mythological, mystical, magical, religious, or spiritual traditions.

Even though these venerable traditions claim to have the right approach for understanding it all through a kind of science or theology or magic or whatever, none of these traditions is universally accepted by everyone as *the* way the world actually works. Comprehensive learning favors exploration of all traditions and all perspectives not focusing on any one tradition. In particular, comprehensive learning can sometimes explore quite narrow traditions, not just the allegedly universalist ones.

Comprehensive learning favors exploration not explication. Exploration gives us a deeper understanding of how each topic and each tradition works. Attempting to choose the "right" theory, model, or tradition to focus on seems short-sighted as future insights may challenge our beliefs and theories. Exploration engages us to better understand the constellation of ideas and possibilities instead of becoming defensive or entrenched when our favorite beliefs are upset by alternative interpretations or facts. Comprehensive learning aims to continually broaden our sense of the possible ways to understand our worlds while also deepening our understanding of the many traditions that contribute to our civilization including the universalist ones.

By challenging our thinking with an ever-broadening context, comprehensive learning recognizes that yesterday's learning may only have scaled the heights of a small foothill in the mountainous range of all possible understandings. By descending from this foothill and searching far and wide, we might find a higher foothill with more effective knowledge. This taller mountain might make yesterday's preferred approach seem "obsolete" by revitalizing a long abandoned approach with new incisiveness. However, tomorrow we may find yet another even taller mountain. We can't be sure which approaches the next mountain might reveal to be short-sighted and which long abandoned approaches it might revitalize.

Some evidence for this fact can be found in the ever-changing evaluations of Aristotle and Epicurus who seem to be alternately refuted and revitalized every other generation. Or consider how biology now recognizes transgenerational epigenetic inheritance despite rejecting Lamarckism, the idea that organisms might inherit physical traits from their parents.

So, comprehensive learning is about exploration not explication, not choosing the best tradition, theory or model, but clarifying each tradition through comparisons and other examinations that strive to deepen our cross-cutting understandings of all Humanity's traditions. It should not be about choosing the winner in the race to identify the best tradition because that race might not even get really going for a few more centuries! It may be that Humanity has only just left the "womb of permitted ignorance" to repurpose Bucky's words. We may still be at the very beginning of understanding the world and how it works. There is more on the idea of comprehensive exploration in the resource "Comprehensive Exploration, Comprehension, and Collaboration".

Comprehensive learning can be distinguished by a social and collaborative but self-directed learning instead of either the autodidact tradition, which is self-directed but isolated, or lecturing, which is social but other-directed. Truly broad exploration may require a diverse collaborative effort. Each individual adds their own experiences, perspectives, and interpretations to add details, context, and meaning to our collaborative explorations. Each individual also brings new traditions to the group to consider and explore. A consequence of these social aspects is that comprehensive learning is about conscientious listening and dialogue in exploration, not predigested facts and methods.

To maximize the diversity of collaborative comprehensive learning, all backgrounds, beliefs, and cultural traditions should be engaged with no prerequisites. All these factors suggest that collaborative comprehensive learning is likely to be different from the mission-focused collaborative teams of organizations and the discipline-focused collaborations of departments.

In sum, comprehensive learning finds its source in the whole of Humanity's cultural heritage not just great books or approved curricula or any particular canon; it is about exploration not explication, not doctrinaire; and it is about collaborative participation, not a spectator sport.

What is your perspective on comprehensive learning? What should it be about? Which of my distinctions would you embrace and which would you eschew? How should we engage an initiative of comprehensive learning to be "adequately macro-comprehensive and micro-incisive" as Bucky puts it?

What is comprehensive learning and how would you distinguish it from other ways of learning?

22.2 How does comprehensive learning compare to other ways of life?

In the resource "Articulating Comprehensivity: The Comprehensive Design of Our Lives", I argued that comprehensive learning is, in part, about tuning into the way in which we design our lives through the traditions we study in breadth and those we study in depth. Our knowledge in breadth and our knowledge in depth informs our judgment and provides the basis for our skills and capabilities.

In contrast our guidance counselor and human resources conceptions of our faculties as psychological traits and demonstrated competencies ignores what we have learned in breadth even though examples such as Donald Ingber's profound story about how a college art class prepared him to pioneer a new way of understanding biological cells as tensegrities, structures whose islands of compressive elements are held together by a network of tensile elements. In our culture, what we know in depth is widely valorized. However, what we know in breadth may be even more significant: it shapes and structures the context our minds have available for our thinking, interpretation, measurement, and judgment even if we aren't conscious of it and don't talk about it.

In the resource on "Chronofiles", I emphasized the importance of our personally curated archives of documents and artifacts in supplementing the memories, know-what, and know-how stored in the wetware of our bodies. These inventories of collected documents, resources, and artifacts profoundly shape the ability of our future selves to be resourceful in adapting to the exigencies of life. By studying his Chronofile, Bucky Fuller was able to see patterns of technological change that others didn't have the means to see.

Comprehensive learning invites us to reconsider our curatorial practices to more conscientiously shape our faculties by gathering the resources we will need to make observations, comparisons, and other analyses and syntheses in the future. The way we curate our chronofiles and our in depth and in breadth learning shapes and articulates our comprehensive learning, in contrast our society more commonly shapes us with the more limited concepts of building an identity, a career, or a collection of hobbies, skills, and expertise.

Another distinction in the approach of comprehensive learning is to aspire to comprehensive comprehensions (see the resource on Comprehensive Exploration, Comprehension, and Collaboration) which place more value on integrated judgment than decision-making. Comprehensive comprehensions form a thoroughly refined ignorance by identifying and examining the nuanced questions that might distinguish amongst a collection of multiple working hypotheses or perspectives. By fostering our mistake mystique, valuing the identification of mistakes or gaps in our dawning understandings with naïve questions, we can formulate a more refined ignorance of the possible relations amongst our experiences and our hypotheses.

This process may help us better organize our minds for more effective judgment-making. Such an approach might foster a better design sense for our lives and for our civilization than the more prevalent approach of striving for the false certainties and expediencies of expert decision-making, best practices, or majority rule.

Another distinction between comprehensive learning and other ways of life is how it engages us in a gradual, persistent, life-long learning, not training, not point-to-able certificates, not specialized programs of learning. Currently, I imagine collaborative comprehensive learning steered by participant-guided group explorations. By looking to their own experience and their understanding of the group, participant-guides can imagine topics, ideas, or investigations they might creatively present to the group to redress omissions, blindspots, or weaknesses in their group's or their civilization's comprehensivity, the qualities of breadth and depth which one integrates to form an understanding of the world and of each other.

The practice of coming to learn a topic or tradition well enough to present it and guide a group exploration of it, helps participant-guides introduce or elaborate on the traditions they think are most relevant or underappreciated. Alternatively, the group often gives the participant-guide alternative ways of considering the subject. Everyone can learn in such explorations. This contrasts with the way in which learning is usually thought of as involving a transfer of knowledge from source to sink which homogenizes learners as aspiring experts.

In collaborative comprehensive learning, the dynamics of group feedback often leads to better questions and new insights. What is really fundamental for understanding this or that? How can we guide ourselves and our collaborators to a more incisive understanding of our worlds and of each other? The whole process might be an alternative to politics: to deliberate on the issues of importance for our civilization and understand them comprehensively so new ideas for better designing our worlds might be thought through. In this way comprehensive learning is not just an activity to engage when there is nothing good on TV. Instead, it becomes a way in which we and our collaborators search through Humanity's vast inventory of ideas and traditions to teach each other and learn from each other more and more about how our worlds work.

As Buckminster Fuller suggested in the first quote above: to adequately address any of the issues facing world around society, we as individuals need to become "thoroughly and comprehensively self-educated". Comprehensive learning is a new way to do this in groups like The Greater Philadelphia Thinking Society or 52 Living Ideas. The result will be the re-designing of our understanding, our lives, and our civilization. In contrast other forms of learning merely offer individuals access to traditions of inquiry and action to fit into already existing functions of our civilization.

In sum, comprehensive learning helps us become aware of the knowing in breadth and depth that gives us our capabilities and faculties, not building an identity of knowledge, skill, or role. It helps us recognize how curating our learning designs our life, not just accumulating knowledge. It helps us hone our general purpose judgment instead of our special case decision-making. Collaborative comprehensive learning may help us as individuals and as a society become more adaptable, instead of learning being a spectator sport where certificates and ranks are more important than possibilities. In short, comprehensive learning guides us to better design our lives, our worlds, and our civilization.

How do you see comprehensive learning compared to other ways of life? What life possibilities do you imagine might come from the practice of collaborative comprehensive learning?

22.3 Conclusion

The way in which comprehensive learning will develop as a tradition of inquiry and action, like everything else about the future, is unknown and unknowable. It is unlikely that my current imagination of its key features in comparison with other ways of knowing and other ways of life will prove to be suitable. But I hope to instigate you to think about what could be, then, collaboratively we might happen on better ideas. By experimenting and trying out different ideas, we will more quickly converge on an approach that works better than the schema of comparisons offered above.

If the idea of collaboration is as important for developing our comprehensive thinking, as I think it is, then it will be participants like you who will contribute the key ideas and practices for the emerging tradition. My role is to be an instigator to help us consider ideas that might precipitate reflection and practice so that together we might imagine even better ways to formulate *comprehensive learning* as an emerging tradition of inquiry and action.

Addendum: 1h 31m video from the 13 April 2022 event:

23 The Measurements of Life (Tools for Comprehensivity)

07 July 2022 in Resource Center.

This resource examines *measurement* as an important tool for our comprehensivity, our toolkit of ways to better understand the world and each other. It explores and contextualizes measurement inspired by the broad schema called *the measurements of life* discussed in Chapter 6 of *The Design Way* by Harold G. Nelson and Eric Stolterman.

To provide an exemplar of comprehensive exploration, this resource recapitulates and expands on the idea of comprehensive thinking beginning with experience. The importance of experience was introduced as a source for comprehensive inquiry and action in the resource on The Comprehensive Thinking of R. Buckminster Fuller. Several other resources on experience and our comprehensivity were summarized and expanded upon in the resource on The Ethics of Learning from Experience.

This is the second resource in a series on Tools for Comprehensivity. The first one explored Ambiguity, Contradiction, and Paradox.

23.1 The Interpretation of Experience, Information, and Data

R. Buckminster Fuller's approach to comprehensive thinking starts with Universe: "The universe is the aggregate of all of humanity's consciously-apprehended and communicated experience". This all-encompassing inclusion of all the experience of all Humanity is the starting point for any comprehensive inquiry or action. In this way experience is fundamental in all our comprehensive thinking and learning.

Experience is also the basis of our cultural heritage which is regenerated as each generation learns the stories and practices from the traditions (ways of inquiry and action learned from others) curated by previous generations. Experience, cultural heritage (see the resource on The Value of The Ethnosphere), and traditions of inquiry

and action (see the resource on Humanity's Great Traditions of Inquiry and Action) are the three essentially synonymous sources we have identified as the sources for all our learning, the sources for our comprehensivity, our learning that aspires to integrate more and more of Humanity's traditions of inquiry and action to better comprehend the world and how it works.

But, what is experience? In Synergetics 302.00, Bucky Fuller elaborates, "Experiences are either involuntary (subjective) or voluntary (objective), and all experiences, both physical and metaphysical, are finite because each begins and ends." By metaphysical he means the worlds of ideas and social relations which cannot be simply described as the product of electromagnetic, gravitational, and nuclear forces. This amounts to a two-dimensional characterization of experience with one axis for subjective and objective (the dichotomy of involuntary and voluntary) and the other axis for physical and metaphysical (the worlds of things versus the worlds of ideas).

Bucky recommends we start all inquiry with a Universe consisting of all Humanity's communicated experiences. With this overarching context we can subdivide Universe to identify and consider relevant experiences for our inquiry, in our case, experiences about the art of measurement. What experiences about measurement are relevant? This is where the inventory of Humanity's traditions of inquiry and action comes in: if we can find even one tradition of measurement, we can take it as a guide for our learning. Since we started with Universe, we know that there are many other traditions of inquiry and action which we might also consider. If we do not find our first choice to be adequate for our inquiry, we can add more experiences from other traditions until we have an adequate set of experiences about measurement to explore. That will constitute a first attempt at guiding our comprehensive exploration of measurement. Later on, we can reconsider by adding an even broader array of experiences and traditions.

Let's take Chapter 6 entitled "Interpretation and Measurement" of "The Design Way" by Harold G. Nelson and Erik Stolterman as our guide:

> The ``real'' nature of the world is revealed when it is explored as thoroughly as possible in breadth and depth, in order to understand its basic constitution.
>
> —The Design Way, Chapter 6, ``Interpretation and Measurement''

In two recent resources (Ambiguity, Contradiction, and Paradox and The Comprehensive Design of Our Lives), I tentatively proposed a model for our comprehensivity, our inclination to understand it all and each other, as the intertwined *breadth* as diverging for context and *depth* as converging for clarity. *The Design Way* corroborates these basic tenets of comprehensive learning when it says thoroughness in breadth and depth reveals the nature of the world. Breadth and depth comprise our ontology, our sense of the nature of reality, from a comprehensive perspective.

The Design Way continues,

> Information comes to us through direct sensory experiences that are filtered or focused by our perceptual lenses and ordered by our conceptual scaffolding. Or we collect information we have gathered from a variety of secondary sources looked at through a variety of cognitive frameworks. The challenge is to make sense out of all the diversity of data and information.
>
> —The Design Way, Chapter 6, ``Interpretation and Measurement''

The Design Way highlights "data and information". I interpret this as another way to talk about experience. Remember that our Universe is about communicated experience. "Information" and "data" are two words to describe communicated experiences. This focus on data and information reminds us of the science of information theory which treats the bit as a "universal measure" of information as John R. Pierce puts it in his classic book "An Introduction to Information Theory" (see page 8 of the Dover edition). Pierce emphasizes that information theory is a mathematical abstraction of communication. It doesn't include a theory of interpreting data, so it won't help us much.

The Design Way reports that data and information are "filtered or focused by our perceptual lenses and ordered by our conceptual scaffolding". That is, experience, information, and data must be interpreted along at least two dimensions. Our conceptual scaffolding is furnished by our background, our language, our memories, our chronofiles, our culture, in short, the conceptual framework we have built from our comprehensivity, our integrated learnings, some in breadth and others in depth (see the resource The Comprehensive Design of Our Lives). The other dimension of interpretation, the filtering or focusing of our perceptual lenses, is provided by our intentions forming our attitude, stance, or perspective (see the resources How to

Create That-Which-Is-Not-Yet and Shifting Perspectives and Representing The Truth). The way we articulate our perceptual lenses is also furnished by our comprehensivity which provides each person a subset of Humanity's inventory of traditions for perceiving and our inventory of traditions for filtering and focusing.

I tend to think of experience as the really real root of reality, but that is a distorted view. In fact, experience, information, and data are interpreted. Always. The physicist Leonard Mlodinow corroborates the point in *The Design Way* that perception involves interpretation, but Mlodinow uses the word "imagination". I think we will find that imagination is part of interpretation. Mlodinow explains:

> Human perception is not a direct consequence of reality but rather an act of imagination. Perception requires imagination because the data people encounter in their lives are never complete and always equivocal.
>
> —Leonard Mlodinow, The Drunkard's Walk, 2008

The expressions "raw experience", "raw data", and "raw information" try to get at the idea of the actual experience itself. The word "raw" means undigested or not predigested and suggests uninterpreted. But that really real uninterpreted experience is already just an imperfect memory of what actually happened. What we call "raw data" or "raw experience" is just our imagined account of what happened. This imaginative story is "filtered or focused by our perceptual lenses and ordered by our conceptual scaffolding" as *The Design Way* puts it. So what we call raw experience or raw data or the really real reality that actually happened is, in fact, an imaginatively interpreted story about what happened which is quite distinct from what actually happened.

The communication of experience or information or data requires interpretation in the telling or presentation of a story *and* in the listening. Both sides of a communication necessarily engage the *conceptual scaffolding* and the *perceptual lenses* of our interpretive faculty to relate an imperfectly captured impression of what really happened. All we really have is imagination and interpretation. The actual experience of what happened is inaccessible except through our imaginatively interpreted and communicated stories (see the resource The Fundamental Role of Story in Our Lives). These stories, then, are our best attempt at capturing or packaging experience. They compose our inventory of experience, Bucky's Universe, and they are the sources of our comprehensive learning.

Are experience, information, and data always and only about imaginative interpretation? Besides interpretive stories do we have any other means to assess the really real reality undergirding our lives?

The Design Way focuses on design interpretation since the book has the objective of fostering design culture. But I think most of its ideas about design interpretation apply to interpretation in general. Consider this quote:

> [D]esign interpretation is an act of judgment. ...a design interpretation is an appreciative judgment---a picking and choosing of what is to be considered and in what way. For example, appreciative judgment is the type of judgment that determines what will be considered as foreground and what as background, what is important and what is unimportant, what is valuable and what is of little value.
>
> —The Design Way, Chapter 6, ``Interpretation and Measurement''

I think this characterization of interpretation as "a picking and choosing of what is to be considered and in what way" identifies the essential core of all interpretation. All interpretation imagines and chooses the way in which we should consider a constellation of ideas about whatever it is that we are examining. It is not just the constellation of ideas, but the way we consider them that comprises an interpretation. In this way, I find *The Design Way* definition of interpretation, if you will, even better than the dictionary definitions which intimate the idea without scoping it quite so well.

Is interpretation an appreciative judgment? Sometimes? Always? Never?

Does all experience, information, data, our cultural heritage, and traditions of inquiry and action, however you choose to name the source of all our learning, require interpretation? Sometimes? Always? Never?

23.2 The Measurements of Life

In our exploration of measurement, we began with the starting point for comprehensive inquiry and action: the Universe, that is, all Humanity's communicated experiences. We learned that our interpretive faculties are provided by our comprehensivity, the way we furnish our minds with perceptual lenses and conceptual frameworks from the full collection of all our past learnings, some in breadth for context and some

in depth for clarity. We saw that experiences, information, and data are imaginatively interpreted stories. We learned how *The Design Way* defined interpretation as the appreciative judgment made for "what is to be considered and how it is to be considered". Then, juxtaposed with this definition of interpretation, *The Design Way* connects assessment with judgment:

> Whenever a part or aspect of reality is considered important enough to be assessed, a judgment has been made. In design, interpreting reality cannot be done without imposing judgment, which is guided by intention.
>
> —The Design Way, Chapter 6, ``Interpretation and Measurement''

What exactly is the relationship between interpretation and judgment, interpretation and assessment, and assessment and judgment. Does a judgment make an assessment or does an assessment make a judgment? Perhaps, these ideas are overlapping or amorphous? Where does measurement fit in?

Wiktionary defines a measure as "A standard against which something can be judged; a criterion." So, measures are standards for our judgment. This suggests that interpretations are measures; and, indeed, they are. But how can we use measurement as a tool for comprehensive inquiry and action? *The Design Way* proposes a schema for measurement that provides a basis for design inquiry and action which we can also apply to comprehensive inquiry and action. Consider,

> Design interpretation is a way to find out where we are and if we can move in the desired direction, in alignment with our intentions. To do this, we need a background or a foundation, against which our interpretations can be considered. This foundation is not common knowledge or truth—instead it is the measurements of life. The measurements of life involve the consideration of what makes up the worth of our lives, so that we are not simply measuring a set of variables.
>
> —The Design Way, Chapter 6, ``Interpretation and Measurement''

I read this as arguing that while interpretations are a form of assessment, to really evaluate a situation a more penetrating complex of judgments are required. *The measurements of life* are proposed to consider how the direction of our exploration (for *The Design Way* it is a design exploration, but for us it is any learning exploration) can

Table 23.1: The Measurements of Life (adapted from *The Design Way* Chapter 6)

Standards of Life
Commensurable with a standard
Quantitative measures using a scale such as ordinal, graded membership, interval, ratio, cyclical ratio

be more effectively assessed. In particular, they argue that to organize measurement effectively it is necessary to assess "the worth of our lives". Worth suggests a values-based wholistic assessment of the impact on our lives. *The Design Way* proposes a fourfold schema for this assessment or judgment which I summarize in this table:

The standards of life are the ordinary kind of measurement we deploy widely with various quantitative scales many of which are well understood and valued. International standards bodies, the UN, governments, and organizations maintain many such standards which are sometimes enforced by administrative bureaucracies with the merit of keeping us safe from the indiscretions of common mistakes and shysters but with the risk of being pedantic, rigid, and sometimes stupid. An important, but often overlooked, aspect of quantitative measurement is emphatically given by physicist Walter Lewin, "Any measurement that you make without any knowledge of the uncertainty is meaningless." Since all situations involve significant known unknowns and unknown unknowns, quantitative measurements always involve shortcomings. *The Design Way* warns us:

> Life is too rich and complex to be reduced to the sum of rigorous computational scales.
>
> —The Design Way, Chapter 6, ``Interpretation and Measurement'' [NS12]

Perhaps, this penetrating William Cameron quote expresses the challenge of quantitative data even better:

> Not everything that can be counted counts, and not everything that counts can be counted.
>
> —William Bruce Cameron, ``Informal Sociology: A Casual Introduction to Sociological Thinking'' (1963)

So we need more than the standards of life to effectively measure the worth of our lives. Qualitative research attempts to reveal aspects of the meaning and experience of life through observation and exploratory probing. Qualitative techniques include interviews, ethnography, ethology, field observation, literature reviews, focus groups, case studies, user testing, and historiography. The results are qualitative measures incommensurable with established standards though the results can become standards of their own; these are *the qualities of life* in the table. Often qualitative measures can be developed into effective quantitative measures. Indeed, it may be that all quantitative standards developed from qualitative measurements.

Nominal measures name aspects of life that may be relevant for our assessment. These are *the ways of life* in the table. Lists of key named aspects of a situation or initiative are often easier to conceptualize and manage than a profusion of quantitative measures whose relative weights are often difficult to assess. In many situations, the simplest taxonomy, the list, can be surprisingly effective. Qualitative analysis typically includes a survey of the taxonomy relevant to a situation. In this sense nominal measures may be both the most accessible and the most basic kind of measurement.

The spirit of life gets at those aspects of life that are intangible. Ostensibly these "spiritual" aspects seem to contradict the dictionary definition of a measure since they involve no nameable, definable, describable, nor commensurable standard with which to compare. Nevertheless, measuring the spirit of life is both possible and important. The standard to use, which incidentally appears to be essential for all measuring even for quantitative measures, is our judgment. Even secular or "nonspiritual" people have a sense of what might affect the spirit of life, the je ne sais quoi for the joie de vivre (an indefinable quality that makes something distinctive or attractive in the zest of life). Moreover, this ethereal category may be an effective way to capture some of the significance of the known unknowns and unknown unknowns that affect every assessment but may not be well represented in the other three more conventional measures. Unless we check, we can never know if our measure of the spirit of life might reveal a significant issue overlooked by the other measures. So no thorough assessment can afford to omit the spirit of life.

Although in a sense interpretation, measurement, assessment, and judgment are synonymous, there are nuanced layers of meaning for each word. The measurements of life organizes an intermediate role for measurement situated between interpretation and experience on the one hand and a judgment of the status of our intentions on the other.

Interpretation is the necessary art of packaging experiences, information, and data for consideration. The measurements of life look at how our interpretations connect to our situation, initiatives, and intentions. We then integrate an adequate collection of such measures into a judgment to assess the impact on our lives. This background is necessary for the effective assessment or judgment of the direction we are headed in our initiative-taking. Judgment is the most complex and multidimensional word-tool to describe our assessment-making. *The Design Way* develops a thorough taxonomy of judgment in Chapter 8. In conclusion, this broad set of four *measurements of life* offers a comprehensive schema of measurement for our lives, our explorations, and our initiatives.

What benefits and challenges do you see in applying the measurements of life to guide your efforts to assess your situation, initiatives, and intentions?

23.3 The Measurements of Life for Our Comprehensivity

In our lives, each of us is learning comprehensively all the time. Sometimes we take in information in depth to clarify things; sometimes we take in information in breadth to contextualize what is happening. This comprehensivity, our learning in breadth for context and in depth for clarity, furnishes our minds with the perceptual lenses and conceptual frameworks that help us interpret the world.

A useful perceptual lens can be provided by the conceptual framework of *the measurements of life*. The standards of life, the qualities of life, the ways of life, and the spirit of life provide a scaffolding for taking stock of or measuring the effect on our lives of our interpretations in the context of our intentions. These four measurements of life help us clarify and check the quality of our interpretations. They help us assess the situations of our lives, the effects of various scenarios on our futures, and the direction of our initiatives. The measurements of life is a useful outline for assessing the world and evaluating possible futures or design outcomes.

The Design Way treatment of the measurements of life provides a penetrating survey of metrology, the science of measurement, broadly conceived. Not only do we now have a tool to deepen our understanding of measurement, but we also have a guide we can use to assess other ideas about measurement that we might encounter. Finally, this approach to measurement can help us assess our situation, initiatives, and intentions.

This essay was written to provide ideas in support of the 13 July 2022 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 1h 29m video from the 13 July 2022 event:

24 Measuring Beliefs

10 August 2022 in Resource Center.

Measurement, it turns out, is an essential faculty for our comprehensivity, our emerging approach for reimagining our learning, philosophy, science, and life planning by taking seriously Buckminster Fuller's guiding virtue of "the adequately macro-comprehensive and micro-incisive" as a principle for our lives. To help us tune in to the nature and importance of *comprehensive measurement*, this resource examines its application to assessing beliefs.

The previous resource on The Measurements of Life scoped interpretation and introduced the measurements of life schema from "The Design Way" by Harold G. Nelson and Erik Stolterman. This resource builds on that foundation. As frequently happens in comprehensive practice, the task is facilitated by adding another source to consider, namely, Rebecca Goldstein's schema of core beliefs and by reviewing techniques from other resources. Our aim is to clarify the treatment of both beliefs and comprehensive measurement for our comprehensive explorations. Although beliefs are only one aspect of any tradition of inquiry and action, they are important enough that limiting our purview to beliefs will not diminish the effectiveness of our toolkit for comprehensive measurement.

24.1 Assessing Beliefs

Our approach to *comprehensive learning* invites us to consider all the experiences and all the traditions of all Humanity since there is no way to know which might provide a key idea or behavior that we might otherwise overlook. When practiced diligently, this broadly sourced approach to learning will challenge us to consider many unfamiliar beliefs. If we are to better understand the world and each other through engaging so many diverse traditions of inquiry and action, the comprehensive explorer is obliged to understand and situate these unfamiliar beliefs. How might we assess such beliefs?

In the resource The Ethics of Learning from Experience, we learned that Buckminster Fuller adopted the radical ethic of "[abandoning] completely all that I ever had been taught to believe" so that he could re-evaluate his beliefs on the basis of experience including the experiences of those others he trusted. We learned that George Pólya recommended The Inductive Attitude which advises that in order to learn from experience we should be ready to change our beliefs; however, he cautioned that "we have neither the time nor the strength to examine seriously all our beliefs. Therefore it is wise to reserve the day's work, our questions, and our active doubts for such beliefs as we can reasonably expect to amend." And we learned from Patricia Hill Collins that people may adopt "wrong" beliefs especially if they find them adaptable, if they help them to cope better, even if they contradict or hide some truths. After all, we might prefer the more effective belief to the truer one.

The comprehensive explorer finds themselves thrown into a sea of oftentimes unfamiliar beliefs. Should we test each belief against our own experience databanks as Bucky recommended? Should we practice "wise restraint" as Pólya recommended and only consider evaluating those beliefs as "we can reasonably expect to amend"? Should we examine the effectiveness of beliefs regardless of their veracity as Collins suggests? How should we measure the beliefs we encounter in our explorations?

Since the comprehensive explorer values understanding other traditions and peoples, we want to understand their beliefs and not just adopt or eschew them. So, we will want to examine some of their beliefs carefully enough to understand them even if we do not "seriously" evaluate them.

In the resource The Measurements of Life, we learned that all experiences need to be interpreted as there are many possibilities for "a picking and choosing of what is to be considered and in what way" as *The Design Way* by Harold G. Nelson and Eric Stolterman put it. Since beliefs are always embedded in a cultural context, interpreting beliefs in context is an important part of measuring or evaluating them. *The Design Way* then presented a fourfold schema for assessing "the worth of our lives" by examining the ways, qualities, standards, and spirit of life. Should we assess the beliefs we encounter in our explorations using the worth of our lives criteria from the measurements of life?

Yet another way to evaluate beliefs comes from Rebecca Newberger Goldstein:

Goldstein is mainly concerned, in this video, with what she calls *core beliefs*defined as those which we think we would change last even if presented with strong evidence. She identifies six kinds of core beliefs (the list is an acrostic where the first letter of each category spells N-A-T-U-R-E):

1. **Naturalizers**: a coherent natural science is what should be believed
2. **Aestheticizers**: the beautiful is what should be believed
3. **Theologizers**: God should be the ultimate source of our beliefs
4. **Unsolvers**: what to believe has not yet been convincingly given by anyone
5. **Reifiers**: every question can be reified (made into a concrete abstraction) into a new believable category
6. **Epistemoligizers**: beliefs are limited to our ways of knowing

Goldstein and her interlocutor Robert Kuhn see value in each of these ways of assessing beliefs though, perhaps, many of us prefer one kind of core belief to the others. Goldstein invites us "to try to imagine what its like to be [each kind of believer]". As she says, the "flexibility of mind" induced by her exercise would be valuable. I would add, especially for a comprehensive explorer who aspires to understand it all and each other.

Can you imagine what it would be like to adopt the core belief of a naturalizer, aestheticizer, theologizer, unsolver, reifier, and an epistemoligizer?

Goldstein's list can help us clarify the basis for a belief by fitting it into her categories. Conversely, her categories can help us broaden our conception of the kinds of beliefs we might encounter. One omission from Goldstein's list are the designers who believe that they can make real their intentions for a more desirable future (see the resources How to Create That-Which-Is-Not-Yet and How To Explore The Future). I also worry that her categorization risks the biases of Robert Sapolsky's dangers in categorical thinking: 1) we can miss the big picture by focusing on boundaries, 2) we tend to underestimate differences when two cases happen to fall in the same category, 3) we tend to overestimate differences when cases happen to fall on opposite sides of a boundary.

In contrast, the measurements of life aims to help us broaden our considerations rather than pigeonhole them. The ways of life provides a basic taxonomy or list of terms which measures the worth of our lives by names. The qualities of life build upon these nominal measures by clarifying various nuanced incommensurable relationships in a qualitative analysis. Such analyses range from essays and reviews to literature surveys to historical or philosophical analyses to ethnography and ethology to interviews, focus groups, and case studies (see Leslie Curry's exquisite short video course "Fundamentals of Qualitative Research Methods"). The standards of life are those qualities of life that are sufficiently clarified that we can find effective commensurable relationships that might be proven in randomized control studies, the gold standard for scientific research. So the ways, qualities, and standards of life each goes successively deeper into more clarifying relationships. Finally, the spirit of life challenges us as measurers to look deep into our hearts, spirits, minds, and souls to see if we can sense any significant but not-quite-nameable concerns that should affect our evaluation.

The measurements of life engages us in a comprehensive, whole of life approach to measurement. Its three demonstrative measures, the ways, qualities, and standards of life, serve as guideposts to help us identify a battery of specific measures at various levels of depth each of which might clarify aspects of how the various beliefs we encounter in our comprehensive explorations affect our lives. The spirit of life then measures the incisiveness of the more ostensive measures by asking, what of

significance is missing from the story told by our demonstrative measures? Finally, because the disposition of the measurements of life is to assess the "worth of life", it invites us to integrate all our measures into a wholistic judgment about our subject whether it be our beliefs, situation, projects, or objectives.

The word "judgment" used here is complex. It is often used in a coercive or demeaning way to which we bristle "don't judge me!". It can also be used in the narrow sense of decision-making. The notion of judgment I'm evoking and which I read in "The Design Way" attempts to accommodate all factors to provide an integrated multi-dimensional assessment to guide us. In comprehensive practice, judgment ranges from appreciative in formulating interpretations to the more intensive measurement or its synonym "evaluation" to the broader term "assessment" and to the broadest and most nuanced term "judgment" (see Chapter 8 in "The Design Way" which is the most comprehensive exploration of judgment I have seen).

Buckminster Fuller and George Pólya recommend empirical, experience-based, approaches to evaluate our beliefs. Patricia Hill Collins reminds us to consider how beliefs are used to make sense of and guide our life, not merely for their truth value. Rebecca Goldstein's schema of core beliefs gives us six ways to evaluate beliefs. The measurements of life recommends both demonstrative and unformed, incipient, ineffable, or spiritual measures of the worth of our beliefs for our lives. Each of these tools provides guidance for evaluating or weighing our beliefs and those we encounter in our comprehensive explorations.

In which situations might which approach for measuring beliefs be appropriate?

24.2 Measuring Our Comprehensivity

As we learn, we accumulate a growing number of experiences from a growing number of traditions of inquiry and action. So, the number of beliefs we encounter and the number of tools we might use to evaluate them grows combinatorially. Our comprehensivity is how we put together or integrate all we have learned in breadth for context and all we have learned in depth for clarity. It gives us our inventory of concepts and perceptual lenses that becomes our interpretative toolkit. Even more, our comprehensivity forges a toolkit for our lives as all our kinds of inquiry and all the behaviors

in our inventory of actions are built upon the traditions of inquiry and action which we have engaged in breadth or in depth. In fact, as we learned in the resource The Comprehensive Design of Our Lives, how we fashion our comprehensivity is how we shape this toolkit and thereby how we design our lives.

How can we comprehensively measure the beliefs we encounter?

Above we explored the empirical or experience-based approaches of Buckminster Fuller and George Pólya, the effective guidance concern of Patricia Hill Collins, the core beliefs of Rebecca Goldstein, and the measurements of life from *The Design Way*. In other resources, we considered other traditions that can also help us evaluate beliefs. T. C. Chamberlin recommends we use multiple working hypotheses in our evaluations. Tricia Wang recommends shifting perspectives for multiperspectival understanding. Wang also emphasized that the truth is always limited as it is always contextualized with a perspective, so we should be suspicious of the truth of beliefs. The approach of comprehensive comprehensions (developed in the resources Mistake Mystique, Crises of Ignorance, and Comprehensive Exploration, Comprehension, and Collaboration) recommends structuring our hypotheses with questions to build a fabric of thoroughly refined ignorance as a basis for improved judgment-making.

As we all know, many beliefs are in conflict with each other. Our comprehensive approach confronts us with many such conflicting beliefs which may seem irreconcilable. In the resource on Ambiguity, Contradiction, and Paradox, we learned that by embracing and engaging the ambiguities, contradictions, and paradoxes that we encounter, we may gain access to the creative wellspring of great ideas and truths. Each of the tools mentioned could help us measure the beliefs we encounter in our comprehensive explorations.

What other tools for facilitating our comprehensivity might help us better measure beliefs?

Any such tool for evaluating beliefs that we identify, can be named. Naming, by the very act of distinguishing the tool, gives us a nominal measure which the measurements of life calls a way of life. It is possible that such a metric offers enough clarity that it might be considered a quality of life or even a standard of life. Regardless, every named tool for measuring beliefs fits into at least one of the three demonstrative categories of the measurements of life. So *the measurements of life* represents a comprehensive way to encompass any identifiable way of measuring beliefs.

Is the measurements of life approach adequate for accommodating any identified measure of beliefs?

As we comprehensively measure someone's beliefs or those of some tradition of inquiry and action, we might be tempted to organize their pattern of beliefs into an abstract characterization or *world-view*. One scholar considers this approach necessary:

> The notion of a world-view is of fundamental importance in any discussion of people's beliefs, however rational they may appear on the surface. A world-view is a set of fundamental beliefs about reality used to evaluate a wide range of other, more particular, beliefs. World-views are often called metaphysical frameworks in academic circles...World-views can be evaluated, compared and changed, but you cannot avoid having one.
>
> —E. Brian Davies in ``Why Beliefs Matter: Reflections on the Nature of Science'' (2010), p. 2, 3.

It can often be helpful to identify and characterize a world-view. Those who are invested in a single profession, career, trade, art, identity, calling, mission, or vision for their lives may have a well-defined world-view. But, learners may not have a clear, fixed world-view. Many comprehensive explorers are considering multiple contradictory and paradoxical beliefs which might present difficulties in getting a fix on their world-view. Others may hold multiple conflicting fundamental metaphysical beliefs as hypotheses which they try out at different times. Others may be integrating so many new traditions and their beliefs that their world-view changes in rapid succession. Perhaps, world-views should be re-imagined as temporary, incomplete, dynamic, and fluid phenomena?

I would suggest that for many people the better characterization of their "metaphysical framework" would be a measure of their comprehensivity. To start we might organize a nominal listing (ways of life) of all they have explored in breadth for context and in depth for clarity as well as their intentions for further building their comprehensivity. If there is time and inclination, some of these traditions could be more deeply evaluated as qualities of life or as standards of life. We must also evaluate the spirit of life by looking deeply into our hearts, spirits, minds, and souls to try to sense any unformed or incipient or ineffable or spiritual concerns whose significance, if

only we could name them, should affect our assessment. Eventually, we will have evaluated the worth of our life for each metric considered. Finally, we would integrate all these measures into an overall sense of the worth of our life of our comprehensivity. This would be our moment-in-time measure of our comprehensivity.

Does a comprehensive measure of your comprehensivity provide a snapshot-in-time glimpse of your ever-evolving world-view?

Is comprehensivity a better way of thinking of the influences on a person than a world-view?

24.3 The Vital Role of Measurement in our Comprehensivity

Comprehensive learning aspires to integrate more and more of Humanity's traditions of inquiry and action to better comprehend the world and how it works. To make sense of all these traditions, all their experiences, stories, behaviors, beliefs, questions, and initiatives, we need a tool for comprehensive measurement. Given our always limited experience, we can never know if our survey has been broad enough to ensure that we have found the best way of measuring comprehensively. So far, the measurements of life from "The Design Way" is the best tool we currently have to assess beliefs, projects, objectives, and more. Moreover, we can use this approach to assess our current comprehensivity. The result may give us insights into how to refine our comprehensivity going forward to better design our lives. For all these reasons, comprehensive measurement is a vital tool for our comprehensive practice.

This essay was written to provide ideas in support of the 17 August 2022 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society.

Addendum: 1h51m video from the 17 August 2022 event:

25 The Standard for All Measurements: Our Judgment

08 September 2022 in Resource Center.

Collaborating for Comprehensivity has the vision of engaging groups of people to compose ever broader and deeper and more integrated understandings of our worlds and its peoples. To facilitate explorations of particular ideas it is invaluable to share relevant resources with participants so they can be better informed for the conversation. It is most convenient for participants if such references are free to read on-line, though this is not always possible. Since not all participants will have time to review the resources, a summary of them should be provided to make each exploration as accessible as possible.

In order to really understand how measurement works, both in physics and in general, this essay begins with a 1927 analysis by Percy Bridgman on the activity of measuring lengths. The first part of his path-breaking book The Logic of Modern Physics (pp. 3–28 are our current interest) is free to read on-line, so it is an excellent resource for this and other topics about an operational approach to learning which emphasizes the activities and procedures involved in how we come to understand the world. Participants are invited to read the first three sections of Bridgman's book under the heading "The Operational Character of Concepts", namely "Einstein's Contribution in Changing Our Attitude Toward Concepts", "Detailed Discussion of the Concept of Length", and "The Relative Character of Knowledge". This essay summarizes this material for those who do not have time to read Bridgman's account and organizes it to explore the nature of comprehensive measurement.

This is the third part in a trilogy of essays exploring comprehensive measurement using multiple sources and traditions of inquiry and action. This approach to comprehensive measurement was inspired by Chapter 6 "Interpretation and Measurement" and Chapter 8 "Judgment" in *The Design Way* by Harold G. Nelson and Erik Stolterman; however, that book is not free to read on-line. The first part of this trilogy was The Measurements of Life; the second part was Measuring Beliefs.

25.1 The Nature of Measurement

In our culture, measurement is one of our highest values. Measurement guides our science, our corporations, our organizations, our civil society, and our government. But what is measurement? How does measurement work? How can we scope the nature of *comprehensive measurement* as an important tool in working to understand it all and each other?

In the resource The Measurements of Life, we used the definition of a measure from Wiktionary: "A standard against which something can be judged; a criterion." Wiktionary defines a standard as "having recognized excellence or authority". We might infer that a measurement is an authoritative judgment. Can we justify such a definition in science?

Percy Bridgman, the winner of the 1946 Nobel prize in physics, believed that how the activity of measurement was performed was crucial to our understanding. He called the consideration of activities, doings, or happenings an *operational* analysis. He used the approach to decisive effect in his Nobel-prize winning research on high-pressure physics where he invented a series of new ways of measuring pressure when all available gauges failed at the pressures he produced.

To better understand this way of understanding measurement, let's follow Bridgman's operational analysis of measuring length from "The Logic of Modern Physics" (1927). Bridgman's full description is fascinating reading. Let me summarize it.

Even the most basic length measuring procedures involving the coincidence of the ends of our ruler with the object to be measured can be complicated. We need to worry about the material of the ruler, its temperature, its mechanical, gravitational, and electromagnetic interactions, not to mention the difficulty in laying the ruler down successively in a straight line. For measuring large objects we need the procedures of the surveyor who combines the outputs of their angle measuring theodolite with

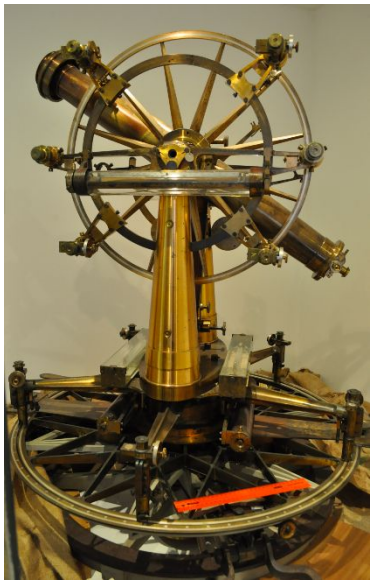


Figure 25.1: Theodolite

the results of their rulers. The angular character of these measurements depend on the optical nature of light which includes the assumption that the line of sight is straight in the sense of Euclidean geometry. But space or the optics of light might be non-Euclidean, therefore there may be curvilinear distortions that affect our measurements. Bridgman reports that numerous checks have been made to reassure us that the error from these factors is small for most terrestrial measurements. But we have no way of ensuring that some non-Euclidean effect might distort our results. Indeed many measurements on Earth require accounting for the spheroidal nature of our home planet; Bridgman points out that the speed of Earth's rotation affects some of them. The complications compound if the object we are measuring is moving instead of stationary.

Bridgman writes, "In principle the operations by which length is measured should be uniquely specified." Until we prove that each possible variation in our operational procedures does not affect our result, we must estimate the error of each of our actions to know how precisely we can report the length. Bridgman observes, "all our experience is subject to error". So to be cautious and comprehensive, we should record the trajectory, velocity, and acceleration of all motions involved in each of our measurement procedures. This diligence first becomes significant if the speed

of the object is very high. Then the Einsteinian relativistic effects need to be taken into account including the difficulties of synchronized clocks to make simultaneous measurements. Bridgman indicates that Einstein's length is conceptually different from our stationary or low speeds notion of length since different operations are involved, though the two "lengths" have "certain features in common" as Bridgman puts it.

Can two operations that agree in certain aspects but differ in others be considered "the same"? Is there one concept of length or several partially overlapping ones that are hodgepodged together?

Even if the speeds are modest, the difficulties of getting ruler and object into coincidence can be challenging as anyone who has attempted a precise measurement well knows. When we try to measure the lengths of objects at the astronomical scale, the optical nature of such large scale measurements cannot be checked by a ruler. Astronomers resort to inferences using the hypothesized principles of physics to infer lengths. Bridgman observes, "Thus at greater and greater distances not only does experimental accuracy become less, but the very nature of the operations by which length is to be determined becomes indefinite". At this scale the possibly non-Euclidean nature of space or optics becomes a significant source of uncertainty.

Gauge Blocks

The nature of the operations involved changes again when we measure very small lengths. Machinists use guage blocks, which Bridgman calls Johanssen gauges after their inventor, to measure at the micrometer scale (millionths of a meter). Such precise measurements are possible, but it requires extra care to avoid dirt or adsorbed

films of liquid or gas or working in a vacuum. Bridgman observes, “the gauges themselves are atomic in structure, that they have no definite boundaries, and therefore no definite length, but that the length is a hazy thing, varying rapidly in time between certain limits”. Bridgman also mentions microscopy. As I understand it, x-rays and electrons have small enough wavelength to discern very fine details at this scale but the quantum electrodynamics interactions between measuring rod and object give indefinite lengths. Bridgman’s point is clear: length measurements at the atomic scale become indefinite.

Bridgman concludes, “We have made the discovery that there are *essential* physical limitations to the operations which defined the concept of length.” In addition, he points out that when the actual procedures differ between one kind of measurement procedure and another, we might have two or more different concepts. Bridgman explains it this way:

> We must always be prepared some day to find that an increase in experimental accuracy may show that the two different sets of operations which give the same results in the more ordinary part of the domain of experience, lead to measurably different results in the more unfamiliar parts of the domain.
>
> —`` The Logic of Modern Physics'' (1927) by P. W. Bridgman, p. 24.

In Bridgman’s last treatise on the operational approach he pioneered, he notes that while it is impossible to be certain that our measurements are not faulty due to unknown factors, we can do enough testing of our doubts and the doubts of our critics to have some rudimentary confidence in our ability to measure and understand the world. Here is how Bridgman put it:

> In the end, when we come to the place where human weariness and the shortness of life forces us to stop analyzing our operations, we are pretty much driven to accept our primitive operations on the basis of a feeling in our bones that we know what we are doing.
>
> —`` The Way Things Are'' (1959) by P. W. Bridgman, pp. 43--44.

Spirit of Life
Ineffable Measures (dawning awareness; integrated sensibility)
Values revealed by looking deeply into our hearts, spirits, minds, and/or souls to try to sense any

We might now apprehend that measurement in physics is the process of making an adequate exploration of the macro-comprehensive and micro-incisive considerations that might guide us to an adequate assessment or judgment of a physical concept. We might then realize that measurement is about our competence in making an uncertain but authoritative judgment given a conscientious evaluation of such considerations. So it seems that measurement, in general, is nothing more than an authoritative judgment however uncertain.

The comprehensive explorer, like the physicist, is always encompassed by an inescapable morass of uncertainty. Nevertheless, we can undertake adequately broad and deep evaluations or measurements to develop competent judgments even though we can never be certain of our resulting beliefs. Our judgments are the authority or standard for our interpretation of our measurements.

Is judgment the standard for all our measurements?

25.2 Comprehensive Measurement

In examining the quantitative measurement of length, we learned that the operational criterion for determining value is our judgment adequately and conscientiously applied. Now, let's consider comprehensive measurement which, if we better understood it, might help us better understand the world and each other. *Comprehensive measurement* is any attempt to broadly and deeply take stock of or evaluate a situation, initiative, or intention. How might we approach the task of comprehensive measurement?

We began outlining comprehensive measurement in the resources The Measurements of Life and Measuring Beliefs. Our approach was inspired by Chapter 6 "Interpretation and Measurement" in *The Design Way* by Harold G. Nelson and Erik Stolterman. It invites us to consider four broad ways for assessing the worth of our lives as summarized in this table:

Table 25.1: The Measurements of Life (inspired by *The Design Way* Chapter 6)

Spirit of Life			
Ineffable Measures (dawning awareness; integrated sensibility)			
Values revealed by looking deeply into our hearts, spirits, minds, and/or souls to try to sense any unform			

The overview provided by the measurements of life is helpful for reminding us of the full range of measures possible. As we go from left to right in the table we proceed from in-breadth (contextualizing) measures to in-depth (clarifying) measures. So, the headings provide four guideposts for identifying relevant measures at different depths or level of rigor to more thoroughly evaluate our situation. Each measure we consider should be evaluated for its affect on the worth of our lives. To determine an overall measure for our situation, initiative, or intention we need to judge the integrated weighted significance of all the constituent measures considered.

As we begin to assess any situation, we might start with the spirit of life. We might look at the whole of the integrated sensibility we have of our situation, initiative, or intention. We might list all the factors we think are relevant. Then we can ask what incipient, dawning awareness might help us further evaluate our situation. We might be so led to name more considerations. We might identify qualitative research explorations we should undertake to better understand the situation. We might identify quantitative research initiatives we should undertake to better determine key factors and set standards. Then we might again look deep into our hearts, spirits, minds, and soul to see if we can't identify any additional unformed, incipient, ineffable, intuitive, or spiritual factors or concerns that we should keep paying attention to as we gather any detailed measurements we might choose to collect. In all cases we try to tune into how these factors impinge on our situation and affect the worth of our lives.

The measurements of life helps us search for a broad collection of measures at various levels of depth and rigor that are relevant in our particular situation. We must first inquire into the set of measurements to collect. Then we need to decide on the operational procedures we will use to collect our measurement data. Percy Bridgman's operational analysis reminds us of the uncertainties that any measurement procedure involves. Once we have collected our data, we will want to consolidate them into an evaluation or integrated measurement of our situation. We should include all our

demonstrative measurements from the ways, qualities, and standards of life as well as any unformed, ineffable, intuitive, and/or spiritual measures from our spirit of life. Our integrated measurement will be our judgment of the integrated significance of weighing each of our particular measures on the worth of our lives.

In this way we might begin to see how judgment is each individual's personal application of all our gathered measurements for a particular situation (our particular knowledge). This leads to the very important definition of judgment in "The Design Way":

> Judgment is knowing based on knowledge that is inseparable from the knower. By this we mean that judgment is based on a type of knowledge that is generated in the particularity or uniqueness of a situation[.]
>
> —Chapter 8 on ``Judgment'' in The Design Way by Harold G. Nelson and Erik Stolterman

Perhaps, we thought that the knowledge that is separable from the knower, that is objective knowledge, was at the heart of measurement. But we have just determined that our judgement is at the heart of measurement.

Let's recapitulate. We learned from Bridgman's operational analysis that the only confidence we can have of our measurements is our judgment from all our experiences testing alternative operational procedures. Moreover, we have to judge which measurements to weigh most heavily and how to integrate all the measures we have considered into our evaluation of a particular situation. In addition, each person's sense of the spirit of life measures will be unique. Our judgement for a measurement is the integrated significance we determine from our weighings of the many factors considered upon the worth of our lives in a particular situation.

Judgement is unique to particular individuals with their particular comprehensivity in particular situations. It cannot be delegated to government, corporations, organizations, or even to artificial intelligence (AI). Instead it is the uniqueness of our judgment that is necessary to decide when our inquiry is adequate, when our approach is adequate, when our measurement is adequate, when our procedures are adequate, and what kind of adequate judgment we should make. In the final analysis, we discover that all measurement is subjective: it is subject to the individual's particular judgment.

The measurements of life and Bridgman's operational analysis of measurement give us a preliminary procedure for comprehensive measurement. As we learn more, we may refine our emerging approach. At this stage, we can take as our first cut analysis that *comprehensive measurement* is a form of judgment that integrates an adequate set of particular in-breadth and in-depth measurement procedures to conscientiously evaluate each particular situation of concern with the worth of our lives criterion.

How will you practice comprehensive measurement for your comprehensivity, your way of understanding our worlds ever more extensively and ever more intensively.

25.3 Comprehensive Measurement, Judgment, and Our Comprehensivity

We can think of our comprehensivity as how we integrate all we have learned in breadth for context and all we have learned in depth for clarity. In that sense our comprehensivity is how we measure our lives. The indicated integrative function of our comprehensivity requires measurement which, in turn, depends on our judgment. Conversely, comprehensive measurement is about applying one's comprehensivity to evaluate particular situations of interest. Now, we can see that comprehensive measurement is central to our comprehensivity. Judgment is the standard or criterion for our measurements. So judgment is also of central importance for understanding and developing our comprehensivity.

As we discussed in the resource on The Comprehensive Design of Our Lives, our comprehensivity is a vitally important way in which we shape and design our lives. Measurement and judgment can now be seen as important faculties or tools for shaping our lives. Learning to think carefully about and practice good operational procedures for making good measurements to better inform our judgments will affect the way we shape and design our lives.

This essay was written to provide ideas in support of the 14 September 2022 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society).

Addendum: 2h1m video from the 14 September 2022 event:

26 Intellectual Virtues for Comprehensive Practice

07 October 2022 in Resource Center.

By examining considerations from traditions that have examined intellectual virtues, we may come to better understand the virtues we need to develop our comprehensivity, our ability to comprehend our worlds broadly for context and deeply for clarity by taking seriously Buckminster Fuller's aspiration of "wanting to understand all and put everything together".

This resource will look at one 10 minute video lecture from Linda Zagzebski's exquisite course on "Virtue Ethics", produced by the University of Oklahoma, to spur our thinking about the intellectual virtues that might help guide our comprehensive practice, our comprehensive participation in our worlds. The result will give us an opportunity to review all 25 of our prior resources.

26.1 Intellectual Virtues

R. Buckminster Fuller's approach to comprehensive thinking starts with Universe: "The universe is the aggregate of all of humanity's consciously-apprehended and communicated experience". This source for our learning can be seen as the collective cultural heritage of Humanity through all history. From this vast heritage, we have accumulated many traditions of inquiry and action. These traditions and their accumulated experiences are the sources for all our learning.

Comprehensive thinking is any effort to explore this vast inventory of experiences and traditions to address our concerns, intentions, and situations. In the resource The Measurements of Life, we learned that an interpretation is what to consider and how to consider it. So comprehensive thinking can also be seen as the process of forming interpretative stories building on our inventory of traditions and experi-

ences. But to be comprehensive, comprehensive thinking aspires to further examine these stories with comprehensive measurement or assessments to form “adequately macro-comprehensive and micro-incisive” (Buckminster Fuller’s catchphrase for our comprehensivity) judgements to better engage our worlds and its peoples with understanding and effectiveness.

With this context for our exploration, what are intellectual virtues?

Our intellectual faculty refers to the regulation and guidance of our mental activities. So the intellectual virtues involve identifying exemplars, models, habits, or disciplines that can serve as guideposts to better organize our mental inquiries and actions.

To help us better tune into and identify intellectual virtues, let’s consider a short ten minute video lecture from 2015 by Linda Zagzebski:

Zagzebski reports that she wrote a book “Virtues of the Mind” in 1996 developing her thinking about how intellectual and moral virtues intersect with epistemology, the science of learning and knowing. Since I haven’t read her book, let’s focus on what’s in the video. Zagzebski says the motivation for intellectual virtues is “to get the truth about the world for ourselves and for others”. She adds, “we need to believe the truth for almost anything else we want”.

In the resource Shifting Perspectives and Representing The Truth, we learned from an exquisite 2016 video lecture by Tricia Wang that truth is always multi-perspectival. Wang went so far as to sternly caution us: “don’t trust the truth”. In that resource, I explained that truth can be seen as the coherence of a perspective or hypothesis with the experiences and beliefs that justify it. The recent resource on Judgment clarified that the justification for truth can now be seen as the process of organizing an adequate set of in-breadth and in-depth considerations, including ineffable or spiritual ones, to conscientiously evaluate the worth of our lives in our particular situation.

With these considerations of truth in mind, I would interpret Zagzebski’s use of the language of “the truth” as a shorthand to refer to effective judgment-making in support of effectively engaging our worlds and its peoples. That is, “the truth” can be seen as our guideposts for knowing that can assist us in making assessments. In that sense the truth *is* a motivation for identifying ways to help us better guide our mental activities with intellectual virtues.

Zagzebski highlights several intellectual virtues including curiosity, inquisitiveness, humility, open-mindedness, perseverance, attentiveness, thoroughness, and carefulness. Her guidepost for assessing all virtues is Aristotle's great moral principle that the good lies at the mean between two extremes. That is, the assumption is that for each proposed intellectual virtue, we can have too much of it or too little and that virtuous behavior lies somewhere between these extremes. In the resource on The Whole Shebang, we introduced *the adequate* as an important way of considering the whole of a situation with our desiderata and intentions as a basis for judging breadth, depth, and value. The adequate has been our way of gesturing to something like the idea of Aristotle's moral principle of the mean.

Aristotle's mean suggests that the good is always some "intermediate between excess and defect" as my translation of the Nicomachean Ethics puts it. I prefer the notion of the adequate because it invites us to determine what may be necessary and sufficient for at least this particular inquiry or action while maintaining the advantages of Aristotle's mean for avoiding harmful behavior such as analysis paralysis, value paralysis, and the paralysis of the whole (three dangers of comprehensive thinking discussed in the resources on The Necessities and Impossibilities of Comprehensivism, How to Create That-Which-Is-Not-Yet, and The Whole Shebang.

Broadly speaking, I like Zagzebski's list of intellectual virtues. Curiosity, open-mindedness, and thoroughness entreat us to explore in breadth for context. Perseverance, attentiveness, and carefulness entreat us to explore in depth for clarity. Inquisitiveness is generally useful for both in-breadth and in-depth exploration. Her list broadly concurs with our approach to comprehensivity, our practice of striving to form broadly and deeply considered comprehensions about our worlds and its peoples.

I particularly like the way in which Zagzebski combines intellectual humility and open-mindedness in her observation that "intellectual humility makes us realize that we might be wrong about a lot of things. Open-mindedness makes us look at reasons for and against a belief." This combination of two virtues comes pretty close to our virtue of mistake mystique, the realization that there will always be inherent gaps in our understandings, communications, actions, and outcomes which we should identify and strive to reduce (mistake mystique was developed in the resource on Mistake Mystique in Learning and in Life and elaborated on in the resource Redressing The Crises of Ignorance.

When Zagzebski says, “Part of being a person is having one’s own consciously developed point of view”, I think she means that our comprehensivity as everything we have learned in breadth for context and in depth for clarity prepares us to make adequate judgements to measure each particular situation. When Zagzebski adds that “Anybody who really treats all points of view as equal is not a person”, we first delight in the wonderful contradiction that the subject of her sentence, “anybody”, might not be a person! As we explained in the resource on Ambiguity, Contradiction, and Paradox, there is often a deep truth beneath many contradictions and paradoxes. I interpret Zagzebski to be pointing out that the very nature of our comprehensivity will incline us to some points of view. Admittedly, the experiences and traditions that we are most familiar with and most esteem will incline us to favor some points of view. She is right about that.

But, I feel the need to push back a little here: as explorers it behooves us to treat all points of view as equally valid so that we might seriously consider them all as we work toward developing an adequate weighing of the relative merits of each. Zagzebski is correct that life is short and we will not be able to thoroughly examine all possible views. The paralyses (mentioned above) that plague our ambition to be comprehensive must be contained. She is also correct that we will need to, putting it in my language, settle for a judgement of the adequate as we comprehensively measure any particular situation.

One advantage I find in the notion of the adequate is its ability to expand to require more breadth and clarity as we learn more. Learning is an iterative affair and what was adequate yesterday might not be adequate tomorrow because of all we learn today. We need intellectual virtues that aspire toward more and more breadth and depth as we learn more and more. I felt Zagzebski’s way of curtailing open-mindedness failed to impart this crucial value. She is correct that open-mindedness needs some bounds, but I would limit it with the notion of the adequate applied to particular situations, not the intermediate between abstract unchanging extremes.

What do you think of Zagzebski’s approach to intellectual virtues? Which intellectual virtues do you want to foster to improve the effectiveness of your participation in Universe.

What insights does her approach to virtues provide for our emerging tradition of comprehensive practice?

26.2 Epistemic Virtues for Comprehensive Practice

Linda Zagzebski's exploration of intellectual virtues inspires us to wonder: What intellectual virtues might provide effective guideposts for our comprehensive thinking and doing?

In the resource Comprehensive Exploration, Comprehension, and Collaboration, we summarized the first 18 resources in our resource center with a preliminary proposal for ten epistemic virtues for comprehensive learning. These epistemic virtues identify important values that can help us better learn in support of our comprehensivity, our ability to comprehend our worlds broadly and deeply. Now let's shift to identify intellectual virtues for comprehensive practice.

Is there a difference between Zagzebski's notion of intellectual virtues and the notion of epistemic virtues that I adapted from Lorraine Daston and Peter Galison in their 2007 book "Objectivity" (see the citation in the resource The Value of Multiple Working Hypotheses)? Although there may be nuanced differences between intellectual and epistemic virtues, I think the two terms are effectively synonymous. "Intellectual" evokes the ideas of the regulation of mental activities and "epistemic" evokes ideas about what qualifies as effective knowledge. But since the whole point of intellectual virtues is to qualify effective knowledge and since any sentient being seeking effective

knowledge will need guidance for regulating their intellects, it seems clear that these are merely two aspects of the same thing. To avoid too much focus on the explorer's own mind since we humans tend to quickly get self-reflective if not downright solipsistic when we look inward, I prefer epistemic virtues and its emphasis on guidance about what should qualify as good knowledge rather than a focus on mental activities.

Zagzebski's video on intellectual virtues provides good context for updating our list of epistemic virtues for comprehensive practice. Most of these virtues were first summarized in the resources on Dante's Comedìa and Our Comprehensivity and Comprehensive Exploration, Comprehension, and Collaboration.

26.3 16 Epistemic Virtues for Comprehensive Practice

26.4 Nine Epistemic Virtues for Comprehensive Exploration

Coming to better understand the world and its peoples is a primary objective for comprehensive practice. Each of these nine epistemic virtues identifies tools to guide us when we are exploring.

1. **Experiences / Interpretive Stories / Cultural Heritage:** The aspiration to source all our learning from traditions of inquiry and action that organize our experiences, interpretive stories, and cultural heritage. Each individual organizes all their learning into a Chronofile which always includes artifact enhanced memories even if dates and times are often omitted. Our inventory of experiences and our realization of its primary role in all our lives is the basic moral principle guiding comprehensive practice. It was introduced in the resource on Humanity's Great Traditions of Inquiry and Action, developed in The Fundamental Role of Story in Our Lives, elaborated and reformulated in The Comprehensive Thinking of R. Buckminster Fuller, and further developed in the resources The Value of The Ethnosphere, The Ethics of Learning from Experience, and The Measurements of Life. The idea has been repeated, referenced, or reviewed in almost every other resource.

2. **Adequate Breadth / Macro-Comprehensive:** The aspiration to engage and accommodate a sufficiently large and diverse collection of experiences, stories, and traditions to adequately contextualize our explorations. Breadth and depth were introduced in the resource Humanity's Great Traditions of Inquiry and Action and elaborated on in the resource on The Comprehensive Thinking of R. Buckminster Fuller and Ambiguity, Contradiction, and Paradox.

3. **Adequate Depth / Micro-Incisive:** The aspiration to comprehend each subject we explore in as much detail and with as much clarity or rigor as we judge reasonable given our situation. The limitations on the breadth and depth of our comprehensivity was first explored in the resource The Necessities and Impossibilities of Comprehensivism and reviewed in How to Create That-Which-Is-Not-Yet. The adequate was developed in the resource The Whole Shebang.

4. **Induction (Empiricism):** The aspiration to infer hypotheses or proposals for true beliefs from considered experiences and to evaluate them by assessing their coherence with our full inventory of experiences perhaps supplemented with new voluntary experiences or experiments devised to test them. Induction was introduced in the resource The Inductive Attitude: A Moral Basis for Science and Comprehensivism, discussed further in Comprehensivism in the Islamic Golden Age, and expanded on in The Ethics of Learning from Experience.

5. **Multiple Working Hypotheses / Multiple Perspectives:** The recognition that there are always multiple perspectives from which to consider a subject or situation and multiple hypotheses that may help us understand it. Therefore, comprehensive inquiry and action aspires to identify and consider an adequate set of perspectives and hypotheses to inform our analytical, synthetic, and integrative imaginations. Multiple working hypotheses were explored in the resource The Value of Multiple Working Hypotheses and multiple perspectives were explored in the resource Shifting Perspectives and Representing The Truth.

6. **Adequate Wholeness for Meaning Making:** The recognition that the meaning making process involves the dynamics of gestalt shifts and gestalt crystallizations that bring into focus identified complexes of interdefined, resonant relations that form significant wholes. Jan Zwicky highlights this idea as "the experience of meaning" as discussed in the resource "to understand all and put everything together".

7. Mistake Mystique / Seeing Gaps: Realizing that there will always be inherent gaps in our understandings, communications, actions, and outcomes, mistake mystique is the aspiration to identify and further minimize these gaps through iterative comprehensive exploration and design. Formulating good and sometimes naïve questions can help us identify and negotiate these gaps. Mistake mystique was introduced in the resource Mistake Mystique in Learning and in Life and elaborated on in the resource Redressing The Crises of Ignorance.

8. **Ambiguity, Contradiction, and Paradox:** The aspiration to lean into and deeply explore the ambiguity, contradictions, and paradoxes we encounter in our explorations in the hopes of gaining access to the creative wellspring of developing great ideas and truths. William Byers demonstrates the fundamental importance of these virtues in mathematics as introduced in the resource Ambiguity, Contradiction, and Paradox.

9. **Comprehensive Measurement:** The aspiration to form a judgment assessing a subject or situation by integrating an adequate set of particular in-breadth and in-depth measures where each is evaluated in regard to its affects on the worth of our lives. Non-demonstrative including ineffable measures should be considered along with demonstrative ones. Comprehensive measurement was introduced in the resource The Standard for All Measurements: Our Judgment.

26.5 Five Epistemic Virtues for Comprehensive Comprehension

If we take seriously Buckminster Fuller's aspiration "to understand all and put everything together", after sufficient preliminary exploration we should aspire to integrate our knowledge into a whole picture comprehension of the way things are. Comprehensive comprehension is the general designation for these integrative and consolidating virtues or practices.

10. **Generalized Principles / Abstraction:** The aspiration to find principles or relationships that abstract and accommodate vast subsets of our accumulated inventory of experiences. We learned in the resource "to understand all and put everything together" that these principles typically manifest as meaningful wholes that need to be carefully tested with our induction, our mistake mystique, and comprehensive measurement. The most powerful principles are often developed through careful explorations of the ambiguity, contradictions, and paradoxes in our subject or situation. Generalized principles were introduced in the resource The Comprehensive Thinking of R. Buckminster Fuller and further developed in the resource on Redressing The Crises of Ignorance.

11. **Thoroughly Refined Ignorance:** The aspiration to structure all our learning with a fabric of questions which systematically interrogate the gaps identified by our mistake mystique. That is, to situate all our experiences, perspectives, hypotheses, ideas, and generalized principles in a fabric of thoroughly refined ignorance. The hope is that this network of questions and ideas will better inform our judgment. Refined ignorance was introduced as the "Hypostasis of Knowledge" based on Stuart Firestein's idea that ignorance drives science and Buckminster Fuller's mistake mystique in the resource on Redressing The Crises of Ignorance and expanded on in the resources on Comprehensivism in the Islamic Golden Age, Shifting Perspectives and Representing The Truth, "to understand all and put everything together", Dante's Comedìa and Our Comprehensivity, and What Is Comprehensive Learning?

12. **Integrated Judgment:** The aspiration to better inform our judgment with comprehensive measurement instead of or in addition to a thoroughly refined ignorance, or perhaps, based on some yet-to-be-identified approach(es). I've separated judgment from thoroughly refined ignorance to make explicit judgment-making as a form of comprehensive comprehension. This virtue was introduced in the resource on What Is Comprehensive Learning? and developed further in The Standard for All Measurements: Our Judgment.

13. Design / Evolution / Futures: The aspiration to navigate the big picture of it all through the conceptualities and practices of design, evolution, and futures. These ideas were introduced in the resources on Rethinking Change and Evolution: Is Genesis Ongoing?, How to Create That-Which-Is-Not-Yet, How To Explore The Future (and Why).

14. **Integrities:** The aspiration to integrate all our comprehensive practice into a comprehensively integral whole, into an *integrity*. Bucky's approach to omni-integrity was introduced in the resource Chronofiles: Data Mining Your Life for Comprehensive Thinking. For the time being, I'm thinking this is a catch-all category, hence "integrities" is plural. We need a place for the integrated wisdom of the *Bhagavad Gita* and the *Tao Te Ching*, which the 52 Living Ideas group has explored in depth. I see it as the task of those who have been studying these wisdom traditions to scope them and measure them against our ever-evolving set of epistemic virtues for comprehensive practice. I think such wisdom traditions and all the other *universalist* traditions of inquiry and action offer some way to think of the integrity of it all. How do we map them into our list of epistemic virtues for comprehensive practice? The universalist traditions were introduced in Humanity's Great Traditions of Inquiry and Action and considered further in The Comprehensive Thinking of R. Buckminster Fuller and What Is Comprehensive Learning? We first attempted to summarize integrities in Dante's Comedìa and Our Comprehensivity and developed it in Comprehensive Exploration, Comprehension, and Collaboration and in What Is Comprehensive Learning?.

26.6 Two Epistemic Virtues for Comprehensive Collaboration

We are a predominately social phenomenon; our language, most of our ideas, rituals, and technology have all been almost exclusively inherited from others. To be effective and relevant comprehensive practice must engage this social world by becoming a collaborative enterprise.

15. **Collaborative Comprehensive Exploration:** The aspiration to listen to and work with others by sharing our individually articulated experiences, perspectives, hypotheses, ideas, and comprehensive comprehensions to collaboratively compose new understandings of our worlds and its peoples. This idea was introduced in the resource on Redressing The Crises of Ignorance as a reformulation of Buckminster Fuller's ideas about education automation. It was summarized in Dante's Comedìa and Our Comprehensivity and Comprehensive Exploration, Comprehension, and Collaboration. It was elaborated on in What Is Comprehensive Learning?

16. **Co-Designing Our Lives and The World:** The aspiration to design our lives, our society, and our civilization through our conscientiously and collaboratively developed comprehensivity. Collaborating for Comprehensivity was conceived as a collaborative way of working together to re-design our worlds. This idea was introduced in the resource on The Comprehensive Design of Our Lives and further developed in What Is Comprehensive Learning?

While our schema of 16 epistemic virtues may be adequate for guiding and summarizing the tools of comprehensivity sketched out so far, I am sure it will be revised further as we continue to explore our vast cultural heritage and integrate more traditions of inquiry and action. I think Linda Zagzebski's intellectual virtues are included in our system, but her list of virtues is so basic, so fundamental, that they form a cross-cutting substructure that our list builds upon.

What intellectual or epistemic virtues are most important for your comprehensivity?

What would you add to our list? What would you remove or revise?

What virtues guide you in designing your life, your society, and your civilization?

26.7 Virtues and our Comprehensivity

Every tradition of inquiry and action highlights qualities and behaviors which that tradition views as good. The late great philosopher Kenneth Taylor poignantly observes that we are "norm-mongering creatures" (see this short 1 minute video).

Norms and virtues may be the most basic human ideas as Taylor suggests. Our comprehensivity is the quality of our lives that works toward building our lives and our civilization by forming ever more extensive, ever more intensive, and ever more integrated understandings of our worlds and its peoples. To govern or regulate our comprehensivity, we have identified 16 virtues to help us explore, integrate, and participate in the world comprehensively. It is a good start, but our task is not close to being finished: we have barely scratched the surface of the available traditions to better inform our project.

What ideas from other traditions of inquiry and action from our vast cultural heritage do you think we need to incorporate into our list of epistemic virtues to better help us understand it all and each other?

It is a big project. We need your help to better explore all our cultural heritage to find the tools that will further our quest.

This essay was written to provide ideas in support of the 12 October 2022 session of "Comprehensivist Wednesdays" at 52 Living Ideas (crossposted at The Greater Philadelphia Thinking Society.

Addendum: 1h54m video from the 12 October 2022 event:
https://youtu.be/rZUBEKn8QyM

Video Companion Playlist

1. Video: Humanity's Great Traditions of Inquiry and Action
2. Video: The Necessities and Impossibilities of Comprehensivism
3. Video: The Fundamental Role of Story in Our Lives
4. Video: The Comprehensive Thinking of R. Buckminster Fuller
5. Video: The Value of the Ethnosphere
6. Video: Value of Multiple Working Hypotheses
7. Video: The Inductive Attitude: A Moral Basis for Science and Comprehensivism
8. Video: Mistake Mystique in Learning and in Life
9. Video: Rethinking Change and Evolution: Is Genesis Ongoing?
10. Video: How to Create That-Which-Is-Not-Yet
11. Video: How To Explore The Future (and Why)
12. Video: Redressing The Crises of Ignorance
13. Video: Comprehensivism in the slamic Golden
14. Video: Shifting Perspectives and Representing The Truth
15. Video: The Whole Shebang: "to understand all & put everything together"
16. Video: Chronofiles: Data Mining Your Life for Comprehensive Thinking
17. Video: Dante's Comedìa and Our Comprehensivity

18. Video: The Ethics of Learning from Experience
19. Video: Tools for Comprehensivity: Ambiguity, Contradiction, and Paradox
20. Video: Articulating Comprehensivity: The Comprehensive Design of Our Lives
21. Video: What Is Comprehensive Learning?
22. Video: The Measurements of Life (Tools for Comprehensivity)
23. Video: Measuring Belief
24. Video: The Standard for All Measurements: Our Judgment
25. Video: 16 Intellectual Virtues for Comprehensive Practice

An Interview with CJ Fearnley: Collaborating for Comprehensivism

27. Living Ideas Youtube playlist for video companions: YouTube playlist for video companions

Participate live in these discussions on Zoom every first and third Wednesdays in 2024. See details here: https://www.meetup.com/52livingideas/events/calendar/

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Bibliography

[Ali72] Dante Alighieri. *Divania Commedia*. La Comedia: Foligno, 1472.

[AP65] Dante Alighieri and Lodovico Pizzo. *La vita nuova di Dante Alighieri*. Venezia: Tip. Antonelli, 1865.

[HS94] David Hume and Lewis Amherst Selby-Bigge. *An enquiry concerning the human understanding, and an enquiry concerning the principles of morals*. Oxford: Clarendon press, 1894.

[Pól54] George Pólya. *Mathematics and plausible reasoning*. Princeton, N.J.: Princeton University Press, 1954.

[Ful69a] R. Buckminster Fuller. *Operating manual for spaceship earth*. Carbondale: Southern Illinois University Press, 1969. ISBN: 080932461X.

[Ful69b] R. Buckminster Fuller. *Utopia or oblivion: the prospects for humanity*. Bantam matrix editions QM5263. Toronto: Bantam Books, 1969.

[FA75] R. Buckminster Fuller and E. J. Applewhite. *Synergetics; explorations in the geometry of thinking*. New York: Macmillan, 1975. ISBN: 002541870X.

[Cor77] Edward Cornish. *The study of the future: an introduction to the art and science of understanding and shaping tomorrow's world*. Washington, D.C.: The Society, 1977. ISBN: 0930242033.

[FA79] R. Buckminster Fuller and E. J Applewhite. *Synergetics 2: explorations in the geometry of thinking*. 1st Macmillan pbk. ed. New York: Macmillan, 1979. ISBN: 0020926405.

[Ful81] R. Buckminster Fuller. *Critical path*. 1st ed. New York: St. Martin's Press, 1981. ISBN: 0312174888.

[Wei81] Arnold Weinstein. “The Fiction of Relationship”. In: *NOVEL: A Forum on Fiction* 15.1 (1981), pp. 5–22. ISSN: 00295132, 19458509. URL: http://www.jstor.org/stable/1345333 (visited on 09/22/2024).

[Qui99] Daniel Quinn. *Beyond civilization: humanity’s next great adventure*. 1st ed. New York: Harmony Books, 1999. ISBN: 0609604902. URL: http://www.loc.gov/catdir/bios/random059/99022636.html.

[Hop00] Nalo Hopkinson. *Midnight robber*. New York: Warner Books, 2000. ISBN: 0446675601. URL: http://www.loc.gov/catdir/enhancements/fy0907/99043008-b.html.

[SM09] W. E. H Stanner and Robert Manne. *The dreaming & other essays*. Black Inc. Agenda series. Melbourne: Black Inc. Agenda, 2009. ISBN: 9780977594924 (pbk.)

[NS12] Harold G Nelson and Erik Stolterman. *The Design Way*. Englewood Cliffs, N.J.: Educational Technology Publications, 2012. ISBN: 0877783055. URL: http://www.loc.gov/catdir/toc/fy037/2002192836.html.

[Zwi] Jan Zwicky. *The experience of meaning*. ISBN: 9780773557437.

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