

Education in the Digital Age: Knowledge Dissemination in Upheaval

1. Context

Knowledge dissemination, probably the most critical factor in the fundamental change that the world is going through, is the locus of the conflicting forces that make this change necessary. Once upon a time embodied in the functioning of the various institutions of education, in our days knowledge dissemination effectively transcends its institutional condition and becomes part of the new dynamic texture of our civilization. Subject to expectations of efficiency that the survival and progress of the human species on a global scale entail, work and life undergo a corresponding change. This is reflected in shorter cycles of innovation and production and increased speed in knowledge dissemination and turnover; that is, new information replaces older information at a faster rate. We have left the pragmatic framework of the Industrial Society for good. In the process, its main characteristics—hierarchy, centralism, sequentiality, linearity, determinism, and the sense of permanence—are overwritten by the need for decentralized and non-hierarchic structures (e.g., distribution, self-organizing systems), parallel processes, proactiveness, and transitoriness. To deal with these changes, which the human striving towards efficiency has brought about, would pre-empt my focus on how this change has made new types of knowledge dissemination necessary. (Allow me to refer the reader to my book, [*The Civilization of Illiteracy*](#) (Nadin 1983, 1996) in which I analyze the process in detail.) In this new world, the “education machine” of the past has had a rather hard time re-inventing itself. This is especially obvious in Europe: tradition does not necessarily foster innovation, and even less self-doubt and questioning (Nadin 2000). But the system of education in the USA is not much better off, at least not so much better off as some observers would have us believe (Koret Task Force; Educational Policy Institute; Tyack & Cuban 1995). Educational institutions—more part of the new economy than of the emerging civilization—continue to process by numbers, even though the laptop campus and the virtual university are realities impossible to ignore.

In recent years, much has been discussed and much has been experimented all over the world. Tony Blair of Great Britain made education his election slogan and won. In the USA, George W. Bush promised American voters more investment in education (whatever he means by that). The European Union, not unlike its member states, has commissioned many studies in the field. The Organization for Economic Cooperation and Development (OECD) initiated PISA (Program for International Student Assessment) as part of the larger Indicators of Education Systems (INES) to be carried out over three overlapping four-year cycles. There is PISA-Germany, a national implementation combined with inter-State comparisons, overseen by the Max Planck Institute for Human development (Forum Bildung 1999). If we analyze the tenor of the major findings, expressed in reports and reform proposals of all kind, we will readily realize that nobody doubts the urgency of the task of reforming education. Ingo Richter (2001) described the “seven capital sins” of education politics. In Germany, where education is a matter for each state (“Land”) to resolve, almost every state has issued plans for the future: Baden-Württemberg (Schavan 1997), and Bavaria profiled themselves as favorably inclined towards adopting new technologies and

have invested lots of money in a digital infrastructure. In line with the socialist program of the State's government, the North-Rhine Westphalia State Commission (Projektskizze 2001) came up with a heavy document of compromising directives that attempts to please everyone. It is probably as useful as a compass on which every direction the needle points to is acceptable to someone, while the future cannot be found anywhere on the map. In centralized France, discussions take a heavy nationalistic accent at the Ministry for National Education. Regarding Russia (Heyneman et al. 1995), the continuing decline after the fall of the Soviet empire engendered a nostalgia for what in hazy hindsight appears more appealing than it was in reality: a rigidly structured educational system that dispensed knowledge on the basis of a formula mixing solid science (when needed) with mind-fogging ideology. East of what used to be the Iron Curtain, education is in turmoil: insufficient funds, lack of direction and motivation, a sense of historic despair (No matter what we do, our students have no future!). Add to this Asia and Africa. In the Islamic world, either the *Koran* teachings at the mosques override whatever instruction is given in schools, or education follows a path of historic confusion in schools and university physical plants often beyond repair.

The present is to be found in various forms and in many conflicts—many entrepreneurs hurrying to build a business on the basis of various skills—and an unlimited appetite for an activism of intolerance. Unfortunately, education is not made a matter of present needs, even though everyone, from the traditional Muslim to the relatively enlightened members of the intelligentsia and the wealthy who send their children abroad to study knows that there is no future without a proper education. In the world's few remaining communist countries, education is still prisoner to whatever ideological twists the various dictators impose. China's pragmatic attitude towards its economic development translates only partially into the educational sphere. Education is offered to more students than ever before, but it comes heavily burdened with communist ideology. Japan and Singapore stand out as shining beacons in the Far East; but the situation is still difficult. Singapore's education system is up-to-date technologically, but its goals and methods could be questioned by democratic countries. Japan's educational system tends to form future Japanese (in a mold cast of amazing conservatism) rather than globally minded individuals. As bleak as this broad-stroke description seems, it accounts for a situation that needs to be addressed in terms other than aid programs or modest initiatives for international cooperation.

A weekly news magazine with a large national readership (Spiegel 2001) reports the various suggestions made, which only show confused the situation is: the metaphor of circusart, construction, light, workmanship, music, technology, biology; the new formulae "Make life the main subject matter," "Competence acquisition instead of knowledge acquisition," "No more learning what was, but learning to be," "Learning by earning." Some reformers hold that knowledge only hinders thinking, that education should train abilities in order to equip people for changing the world—that old romantic notion with melioristic overtones that keeps animating some idealistic souls. Others see knowledge as a means for strengthening inner power and determination. Yet others disseminate more scientific and mathematical knowledge, justifying education as a goal in itself because this distinguishes the human species, rather than for any practical purpose.

2. The need for a unifying perspective

The list of ideas, partial or comprehensive programs, assessments, self-assessments, reports, and initiatives is telling insofar as to awareness of the situation, urgency of the task, and the many angles from which it is approached. The list also reveals the common lack of perspectives. There are many answers, some even exciting in the novelty of approach. But almost all tend to a reductionist attitude: take the problem at hand and reduce it to manageable parts in the hope that the solution to a partial aspect will eventually add up to the solution to the whole problem. This is the deterministic perspective of cause-and-effect, Cartesian reductionism at work, but definitely in the wrong context. In the Machine Age, or in Industrial Society, the reductionist approach did not conflict with the nature of human pragmatic activity and its characteristics: centralism, i.e., forces set into motion around a given center, such as a factory or a planning board; hierarchy, i.e., top-down procedures, none of which can be skipped, no matter the level of insignificance or lack of expertise; sequentiality, i.e., a specific step must be completed before the next one can begin, as in the assembly line, or letters in a word, words in a sentence; homogeneity, i.e., all parts must be uniform in order to ensure swift mass production; linearity, i.e., a proportional relation between input and output; permanence, i.e., the end product must be utilizable for a rather long time since need for it is not expected to change and alternatives are difficult to come up with.

However, contemporary human society is no longer in the Machine Age. The new age is characterized by qualities that negate those just described. This negation is expressed in forms of work and existence that no longer fit the mold of explanations and actions appropriate to the Machine Age. Instead of the reductionist approach of Cartesian rationality, an integrative approach is needed in respect to many of our current problems, education included. Education's components are relatively known: people (children, parents, educators, administrators), subject matter (the information that education administrators believe those people should know in order to function in work and society), methods (the ways this information is provided). But the relation among parts has been cast aside. We are good at the physics of the institution and at defining functionality in relation to this physics: we expect a certain output on the basis of what is put into education. But we are not even aware of the need to eventually complement functionality with relational aspects. The various possible actions envisaged by pedagogues, psychologists, educators, politicians, etc. have one commonality: they describe possible *reactions* to the various problems of education. But beyond the horizon of a deterministic understanding of knowledge dissemination, characteristic of the past, reaction has to be complemented by anticipation. And this must happen in our current existence as part of our self-constitution in a new pragmatic framework. A proactive vision and practice of education is a necessity stemming from this new pragmatic framework, from new practical activities different in nature from the practical activities of the Industrial Age.

3. The making of the self

Literacy as we know it bore the characteristics of the Machine Age. We are past the historic

necessity of literacy-dominated knowledge dissemination, just as we are past an existence characterized by literate life and work. The fundamental change that has to come about, if we do not want the crisis to deepen and eventually reach a point of no return the self-destruction of the institution of education is that we come to understand that knowledge dissemination is one of the practical experiences (work, leisure, communication, transportation, etc.) of human self-constitution. It is not education that generates or produces or manufactures the engineers, physicians, astronauts, computer programmers, sanitation workers, teachers, cooks, and coal miners of the future. Rather, it is the pragmatic framework (what we *must* do and how we do it) that motivates individuals from children to adults to mature adults to make themselves engineers, physicians computer programmers, sanitation workers, etc. From the making of oneself as an individual to the constituting of oneself as one of such professionals no longer falls in the domain of schools and universities. For as long as such professions (pragmatic roles) actually had some permanence associated with them—individuals learned once, and chances were good that they functioned in the role for the rest of their life—education seemed like, and indeed functioned like, a machine that turned out such professionals. Today no such permanence can be taken for granted. The physician, who once learned in books and in hospitals all there was to know about bodily functions and human illness, today is obliged to constantly change as progress is rapidly made in medicine and medical technology: computational diagnostics, DNA treatments, microsurgery, laser surgery, stem cell applications, and so much more. The same holds true for the engineer, and even the laborer, subjected to tasks that are simultaneously functional and rational.

As a consequence of this dynamics of change, more education is carried on outside the classical educational institution than within it. Companies, for instance, prepare their workforces in a context in which learning and doing are closer than ever before. Skills are subject to short training cycles, followed by even shorter cycles of deployment. Obsolescence is pre-programmed in the expectation of ever higher efficiency.

The pragmatic perspective is fundamental because it relates education to its purpose: the meaningful self-constitution of the individual through activities that are based on shared knowledge, but which essentially are possible through the individual's cognitive energy. Emphasis is no longer on knowledge subject to rapid turnover, but on cognition. The task and the individuals who carry it out must be viewed in their unity. We are what we do. Aristotle used the word "repeatedly" in this regard; but we now live less and less in a pattern of repeated experiences.

4. Knowledge acquisition and expression: Why?

Having said all this, I realize that the danger of misinterpretation exists: ignore knowledge altogether and focus on cognitive skills. This is not my point. Knowledge continues to be discovered and to serve as the foundation for human life and work. But from knowledge acquisition and expression to its embodiment in artifacts and processes, the duration is decreasing. The manner in which knowledge is acquired and the manner in which it is disseminated and the manner in which it is turned into effective procedures and artifacts are intrinsically related. This is why in a day and age of knowledge acquisition no longer dominated by literacy, but rather by imagery and multimedia, one can no longer pursue literacy-based

dissemination and even less literacy-based implementations. It is not a matter of subjective choice, but of adequacy and efficiency.

The way we acquire knowledge affects our entire relation to it. Our means of expression are not neutral in respect to what we express. They have a constitutive, as well as a descriptive, condition. Understanding the active role of our means of expression and communication should be turned into the premise for all our attempts to change or improve education. Along this line, I expressed, during my lecture in Munich (Nadin 2000), my amazement at the fact that the University here, as in many other universities, still disseminates so-called knowledge in a frontal educational manner that reveals centralization and hierarchy: a lecturer addresses 250 students, using overhead transparencies, rehashing what has been taught for the last 10-15 years or more.

The notion of mass education, not unlike that of mass production and mass media, relies on the Machine Age model of one-to-many. It is a wasteful model, very inefficient in all respects. The pragmatics of our new age favors indeed requires interaction, one-to-one and some-to-some structures. We need to make possible a decentralized education with non-hierarchic, horizontal interaction, configurational environments, and a highly heuristic context of knowledge inquiry and personal discovery. The individual has to be the center of the pragmatics of knowledge dissemination. The problem I had with such classes is not technological. A Website with the same content would be just as bad as the overhead projection. The problem lay in realizing the need to rethink education in order to bring about a new condition of knowledge dissemination.

It is probably already clear that this is no light task. The university lecture I mentioned as an example will not fundamentally improve if students are required to use laptops, if the overhead projector is replaced by a computer and beamer, if multimedia substitutes for transparencies, or, as just mentioned, if the professor puts the content of the lecture on the Web. What is necessary is not new technology, but the new perspective I have been advocating for over fifteen years (Nadin 1991): interaction among minds. This perspective can originate only in our understanding of what makes change necessary. In other words, the question “Why?” should guide us as we consider the following:

1. the sense and meaning of historic development;
2. the nature of change (arbitrary, accidental, or necessary?);
3. the consequences of change.

In what follows, I will interrupt the discussion of knowledge acquisition and dissemination in order to address these questions. There are so many theories about how and why historic developments take place that I cannot summarize them here. (Please accept my renewed invitation to read a discussion of the historic development in [The Civilization of Illiteracy](#).) Instead, I shall submit a new hypothesis and keep the argumentation to that bearable minimum that seems still acceptable to today’s readers (and even to so-called scholars).

4.1. Historic development.

We learned about dynamic systems from mathematics and the sciences. It is obvious that history is an account (probably less accurate than we believe it to be) of the dynamics of human

existence within a certain context (community, society, country, etc.). Dynamics is nothing more or less than change over time: change in forms of work, cooperation, interaction, family life, social organization, political action, etc., etc. The advantage of a systems description is that within a system, the various components are interrelated. Moreover, there are also interactions between the system and the surrounding world—nature in this case. If we agree to view historic developments from a dynamic systems perspective, then we could benefit from the analytical tools of the mathematics of dynamic systems. One of its important descriptions reveals that dynamics systems evolve from relative stability to a condition of instability and eventually undergo a bifurcation once a critical phase is reached (Fig. 1). This model successfully describes considerably complex physical phenomena.

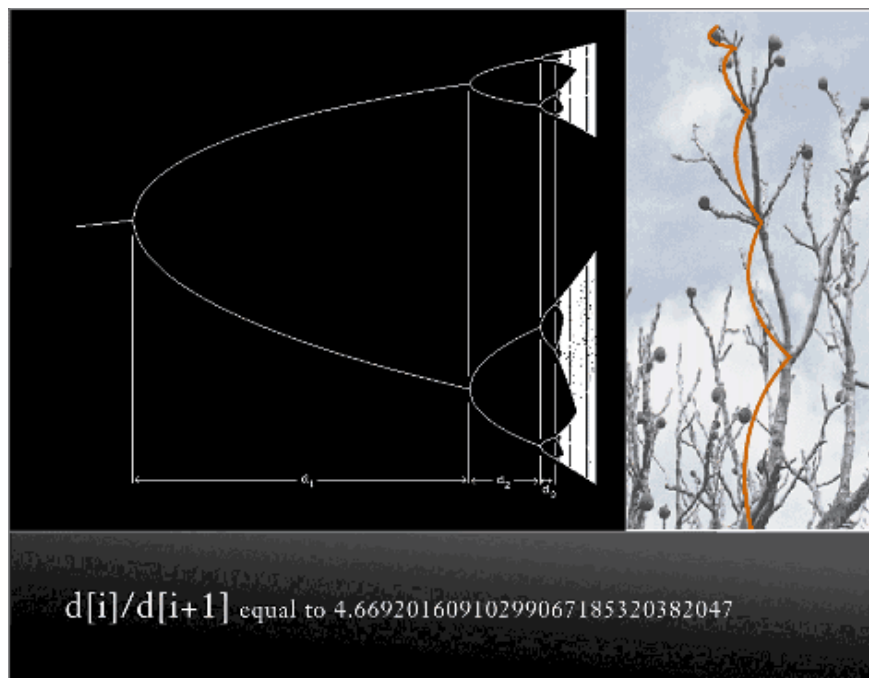


Figure 1. Bifurcations take place at certain intervals

4.2. The nature of change

This image is intended to show that bifurcations take place at certain intervals. Moreover, although there is no simple repetitive pattern (i.e., the time intervals are not equal) and the sequence of bifurcations is not easy to describe, there is a deeper sense of order represented by the relation between two succeeding bifurcations. In studying nature, the dynamics of growth in particular, Feigenbaum discovered a pattern (and a universal number was subsequently named after him). In my example, I took a fig tree (Feigenbaum, incidentally, is German for “fig tree”) and showed how branching takes place in the bifurcation sequence based on the Feigenbaum number (Fig. 2).

Notorious for their impatience with mathematical descriptions, humanities scholars looking at

the image will realize without too much effort what I refer to. Furthermore, they will have no difficulty in following my argument. In the dynamics of history, that is, in the way the pragmatics of human existence changes (from hunting and gathering food, to agriculture, to pre-industrial forms of work, to industrial society, and so on), we can identify a sequence in which the duration of each new pragmatic framework becomes shorter. My hypothesis is that Feigenbaum's number could just as well be considered here. This is not to say that a tree and societal development are the same; rather that the dynamics of living systems is probably coherent. In view of the foregoing hypothesis, the reader will easily recognize that my view of history is formed from the experience and knowledge of dynamic systems.

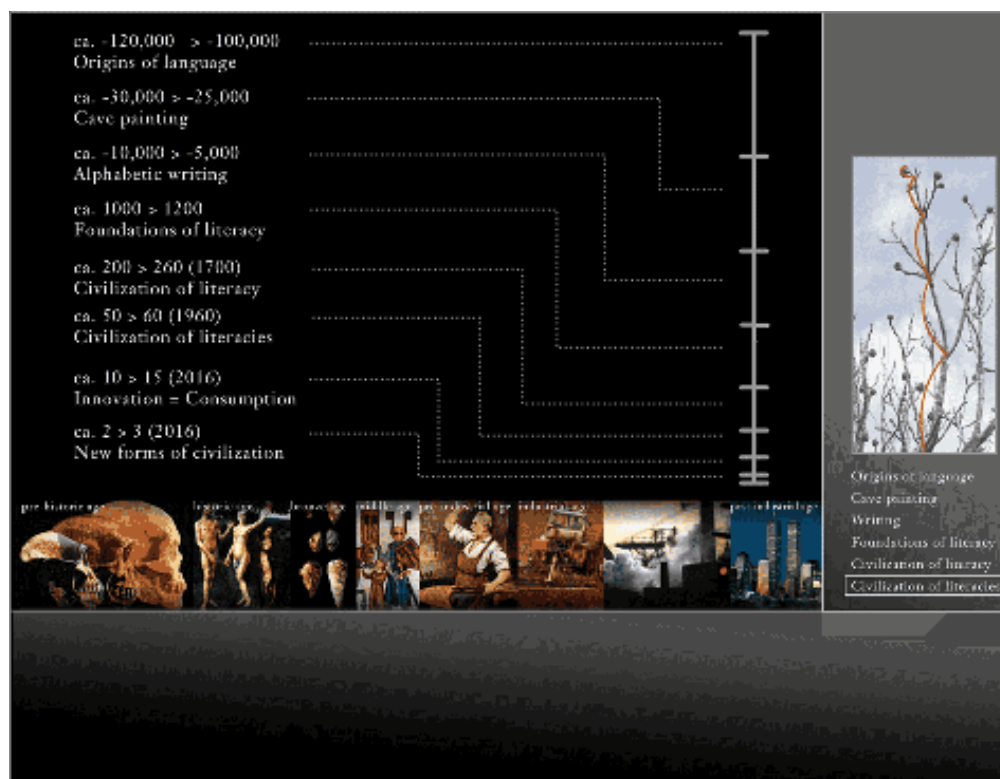


Figure 2. The Feigenbaum number applied to pragmatic frameworks. History is formed from the experience and knowledge of dynamic systems

4.3. The consequences of change

Furthermore, we can more precisely characterize what I call “the civilization of illiteracy,” as well as the subsequent civilization of literacies. The description advanced here states that the expression of the defining characteristics of the pragmatic framework that makes literacy necessary are reflected in alphabetic writing. These characteristics (the already mentioned sequentiality, linearity, centralization, hierarchy, permanence) are being replaced by the characteristics, also mentioned above, of new ways of living and working in the post-industrial age parallel processes, distributed networks, self-organizing systems, short usability cycles.

5. One size does not fit all

With all this in mind, we can now return to the precise aspects of knowledge that motivated this short incursion into what necessitates change. Knowledge dissemination is affected by the means of dissemination. But its efficiency is fundamentally defined by the pragmatic framework. In this respect, I have proposed the introduction of the study of visual means of knowledge dissemination as a required discipline for all the individuals who work in fields where visual phenomena dominate. To see the physical phenomena related to seeing are known and to understand what we see are two different things. To express oneself visually is even more challenging. But short of disseminating visual awareness, we shall continue to underperform in the visual realm. In other words, the individual's cognitive energy will support new practical experiences only to a limited extent. The same conclusion applies to all other means through which knowledge acquisition takes place in our days. *Multimedia*, as a slogan or funding scheme, means nothing unless we realize the nature of the knowledge acquired through multi-sensory channels and expressed in multimedia formats.

In respect to the major matter raised in this text—alternatives to the “education machine model”—it is clear that there is no *one* answer, rather a variety of possibilities corresponding to the ever-increasing variety of human practical experiences on our time. A variety of means and methods will eventually replace the dominant educational system. The alternatives will more and more focus on a proactive educational perspective, as well as on the richness of cognitive processes. They will also do justice to the variety characteristic of the human species. We can no longer afford to ignore this variety by hiding behind politically correct slogans and well-intentioned programs (such as the Core Curriculum). As the pseudo-democratic goal of social and cultural homogenization (e.g., Hirsch 1988, 2014) through education gives way to differentiation, educational philosophy will have to understand and *foster* differences.

Self-organizing nuclei, i.e., groupings that result not from the usual categories (age, for instance) used in educational planning today, but from shared interests or affinities will eventually replace today's standardized classes. The teacher/professor will be replaced by mentors and mediators, individuals who will not only facilitate interaction, but also be involved in the experience as beneficiaries of the dissemination situation. Such functions ought to be understood as transitory: the experience of education will be part of the practical experience for which knowledge is sought and assembled as it becomes necessary. The distributed nature of knowledge in the Post-Industrial Age is paralleled by distributed forms of knowledge acquisition and dissemination. These will most likely be in computational form, but it would be a mistake to exclude other forms of knowledge acquisition, such as the senses and even the old familiar literacy. The current function of knowledge dispensers now played by teachers and professors will be only marginally relevant, mainly for purposes of cultural relevancy.

6. A dynamic network of interactions

The school and university that the Western world inherited from Church-instituted education oriented towards the word of and faith in the hierarchy and from the state, which invested in its

own permanence by promoting its values through the educational system, belong to the past. What will emerge more and more is a dynamic network of human interactions through which knowledge dissemination in forms yet to be experienced effectively takes place. This change cannot be carried out by edict. Its degree of necessity reflects the fundamental change of our global society. No doubt the *Koran* schools of Afghanistan (and many other countries), where wooden tablets serve as a medium for learning by rote, will eventually connect to the world of books, digital media, and networks. This has already happened in many parts of the world. There is no doubt either that the process of reinventing learning will be painful. Traditions are extremely resilient. But for Afghanistan, as well as for many other countries, and even more so for the global world, the answers to the many questions of education as a means for facilitating life and work today and in the future does not lie in the past or in its reinvention under a new disguise. (My reference to Afghanistan is motivated by the sudden interest in the country that recent terrorist acts aroused.) The terrible situation of this country—widespread poverty and illiteracy, high infant mortality, political and religious intolerance, internal strife, subject to all kinds of geopolitical interest—makes it an extreme case from which much can be learned. The country is rather uncharacteristic of the world at large, but probably not so different from many parts of the world where the main resource is the human being, more exactly, human cognitive abilities.

We could save time, energy, and money if, instead of trying to fix what is no longer adequate or acceptable in Afghanistan, as in any other part of the world, instead of trying to turn back the course of history, we start working on alternatives appropriate to the pragmatic framework of the future. These alternatives need not be uniform all over the world; but they will have to reflect the world's global condition. The current crises in the economy (reflected only marginally in the performance of the stock markets), in politics (we still can't figure out how to address political issues, such as terrorism, in a global, decentralized world), in society, in traditional institutions, etc. are the consequences of *reaction* to change, in particular the attempt to maintain old structures and methods that worked well in their past framework. The "No Child Left Behind" Act (2001), providing money for extra educational assistance for poor children in return for improvements in reading and math. It resulted in the weakening of academic standards, instead of raising pupils to competence. Improvements in education was judged on the basis of test scores, putting pressure on teachers to "teach for the test. College preparation was stressed, the result being that young people not fit for college had to be admitted and catered to. Low grades became taboo. Content was watered down. Young people who could have excelled had education prepared them to follow their aptitudes and improve their individual skills, graduate from universities fit for failure and failing society.

An anticipatory course of action, applying proactive, visionary goals, is needed. When the energy of self-organizing nuclei and broader developments collides with the resisting forces of yesteryear, all willing to regulate, norm, censor, and control, the result is waste and loss of value. But if we can afford to lose money—the trillions dissipated in the recessionary trend we are going through—we cannot afford to lose the cognitive energy of those young and less young in need of access to knowledge. We cannot afford to lose the cognitive energy resulting from how different we all are, in particular how different the young people of this world are. Otherwise, their self-constitution as useful and thus valuable human beings is endangered

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