

Apprehending the Future: Emerging Technologies, from Science Fiction to Campus Reality

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ABSTRACT

Emerging technologies are a matter not only of qualitative challenge but also of sheer quantitative overload. Web 2.0, gaming, wireless and mobile devices, virtual worlds, even Web 3.0 in all its unrealized potential—each churns out new developments daily and connects with other domains to ramp up the problem still further. How can those of us in higher education best understand new technologies? The phrases "emerging technologies" and "evolving technologies" remind us that the digital world is largely in flux. New devices, altered applications, and shifting practices keep crossing over the horizon—or quietly appearing in our midst. Deciding which technologies to support for teaching and learning—and how to support them—depends, first, on our ability to learn about each emerging development. Doing so is partly a matter of science fiction, which consists, after all, of the stories we tell about the future. This paper will introduce and explore methods for apprehending the future as it applies to the world of higher education and information technology.

Key Words: Emerging Technologies, Science Fiction, Higher Education.

I INTRODUCTION

Deciding which technologies to support for teaching and learning—and how to support them—depends, first, on our ability to learn about each emerging development. Selecting a platform without knowing what is coming right behind it can be risky. Similarly, it is folly to grasp onto a technology without seeing the variety of ways that the technology can actually be used. If William Gibson was right—"the street finds its own uses for things"—then academic computing needs to be sure of its "street smarts."⁽¹⁾ But trying to grapple with what comes next is a deep problem. Doing so is partly a matter of science fiction, which consists, after all, of the stories we tell about the future. Doing so is also an issue of complexity, since each practice, or device, or network, or application comes embedded in a nest of other practices, or devices, or networks, or applications.

How can those of us in higher education best understand new technologies? The phrases "emerging technologies" and "evolving technologies" remind us that the digital world is largely in flux. New devices, altered applications, and shifting practices keep crossing over the horizon—or quietly appearing in our midst. These are not hypothetical approaches; they are realized, documented, and applied methods. There is no perfect method; nor has any one approach emerged to overshadow the others. This article will thus explore each for its specific affordances, structures, and practical usage. Together, they represent an aggregate, sector-wide movement that tries to help academics understand the future as it hits the present. Put another way, these future-scanners seek to follow the translation of digital ideas from science fiction to campus reality. But trying to grapple with what comes next is a deep

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II DEFINING TERMS

Science fiction contains a speculation about something known in science or technology. There is a "What if ..." question being asked, with possible consequences explored within a story framework. It is a thought experiment. Science fiction can be contemporary or historical, as well as the more familiar far future or space settings. Subgenres of Science Fiction these aren't "official" categories, but terms readers may use when asking for SF titles.

(a) Alternate history

Readers are looking for books where an historical event is imagined to have happened differently, with the resulting changes in technology and society described. For example, Harry Turtledove's 2nd world war novels.

(b) Space Opera

This has become a less useful term. Originally, it was somewhat derogatory and referred to implausible adventure stories that involved travelling between stars. Space westerns, in a sense. Older readers may still use the term that way. Now, however, you'll also find it used in the sense of "far future adventure" and no longer derogatory. As a reference from a reader, keep in mind the ideas of adventure and many worlds.

(c) Military SF

One of the more recognizable categories, typically with book covers showing weapons and uniforms.

(d) Humour, romance, mystery, horror, detectives - Science fiction contains all of these, sometimes in combination. Where possible, note which titles overlap.

(e) Science Fiction Fantasy

You'll see this on books where writers deliberately blend the genres. Magic on spaceships, vampires on the moon etc. Some are very good reads. Some aren't.

(f) Hard SF

This is another evolving term. Originally, it identified stories with detailed, exact science as well as the speculative "what if ..." That science was most often physics, astrophysics, or technology. Many of the early classics were hard SF, and their plots involved puzzles or problem-solving. While there is still this type of SF being written, particularly in short fiction, the term has grown to encompass any science fiction where the science is detailed and exact, giving the reader confidence in the underlying speculation. All sciences are now included, from biology to sociology.

III KEEPING AN EYE ON WHAT'S NEXT

One popular method for seeing what's coming over the horizon is to repeatedly survey that horizon, looking for the leading edges of new projects and trends. This is usually referred to as an *environmental scan* and is based on using quantity to defeat the problem of complexity. Such projects consult multiple sources, comparing details across the spectrum and trying to find complementary perspectives. The projects can be conducted on various timelines, from a single, once-off attempt to continuous monitoring.(2)

Examples of such approaches are plentiful. Several journals and many blogs offer continuous surveys of emerging technologies: MIT's *Technology Review* (<http://www.technologyreview.com/>); Ray Kurzweil's AI.net site (<http://www.kurzweilai.net/news/frame.html?main=news.html>); and Jamais Cascio's "Open the Future" (<http://www.openthefuture.com/>). Of course, journals and blogs themselves are fodder for environmental scanning, since they offer bits of content oriented toward the present. A set of RSS feeds is one of the best tools that an environmental-scanner can possess.

In higher education, the Online Computer Library Center (OCLC) has conducted one environmental scan every few years, the most recent being in 2000 and 2003.(3) The Association of Research Libraries (ARL) published a more recent study, surveying a series of threats, transformations, and opportunities for that sector: scholarly communication, public policy, and the library's role on campus.(6) The EDUCAUSE Evolving Technologies Committee issues reports and an article annually on these technologies, addressing virtual worlds, business process management, location-aware computing, regulatory compliance, and green enterprise computing in 2008.(7)

Another form of environmental scanning for emerging technologies in higher education could consist of members of an academic computing group monitoring a source or a small group of sources and then pooling their observations through regular meetings and/or a blog. A cross-population campus group, perhaps organized by a computing committee or the library, could do something similar, taking advantage of different professional perspectives and backgrounds : faculty, students, librarians, instructional technologists, administrators. With each round of observation and sharing, some themes will begin to emerge. Indeed, such scanning projects can generate their own vocabulary of key terms, an ontology of their futures.

The environmental scan method offers several advantages, starting with the fact that drawing on multiple sources and perspectives can reduce the chances of bias or sample error. The wider the scan, the better will be the chance of hitting the first trace of items that, although small at the moment, could expand into prominence. A further advantage is pedagogical: trying to keep track of a diverse set of domains requires a wide range of intellectual competencies. As new technologies emerge, more learning is required in subfields or entire disciplines, such as nanotechnology or digital copyright policy.

Disadvantages of this method start from its strengths: environmental scanning requires a great deal of sifting, searching, and analyzing. Finding the proverbial needle in the haystack isn't useful if its significance can't be recognized. Furthermore, the large amount of work necessary for both scanning and analyzing can be daunting, especially for smaller schools or enterprises.

IV WORKING THE EXPERTS: THE DELPHI METHOD

A different approach to identifying emerging technologies focuses on experts and their interpretation of events. The *Delphi method*, named after the Greek oracle (the ultimate expert), is process-driven. Experts in a field are assembled, either physically or virtually, and consulted on emergent developments in that domain. The Delphi process can be implemented in a single face-to-face sitting or over an extended period of time. The Delphi organizer might structure a series of discussions, in which the group members compare notes, assess others' observations, and gradually surface a set of topics. That set is then narrowed down through a consensus process. One of the best-known Delphi projects in higher education is the Horizon Project (<http://www.nmc.org/horizon>).

Another application of the Delphi method in higher education is "The Future of the Internet III," produced by another collaboration, this one between the Pew Internet & American Life Project and Elon University. The project leaders developed an instrument and then surveyed a series of experts and thought leaders.

A third project using the Delphi method is the EDUCAUSE Top Teaching and Learning Challenges 2009 (<http://www.educause.edu/eli/Challenges/127397>).

In phase one, the project leaders queried experts and practitioners in numerous focus groups, gradually building up an aggregate model of key issues as identified by the members of this community. Addressing topics that are both similar to and different from those identified by the Pew/Elon and NMC/ELI projects, the top-five issues are cast in a different syntactical form.

The Delphi method offers several advantages. Drawing on experts lets the process leverage professional knowledge. The iteration approach generates a wide range of concepts. And since the method has been practiced extensively and over time, best practices are readily available.(8) The drawbacks are subtle and largely social. One problem is that Delphi outcomes can be driven by a desire for consensus, rather than actual agreement, meaning that divergent ideas can get quashed.(9) In addition, the process can be resource-intensive, especially in terms of time.

V ROLE-PLAYING FUTURES: SCENARIOS

Games enter into another futurological form: the *scenario*. Unlike polls, surveys, or markets, scenarios are social processes based on role-playing. Individuals or teams represent actors in a situation. Scenario organizers portray events through various media and then facilitate as players react in accordance with the actors they are simulating. As defined pithily in the *Forecasting Dictionary*, a scenario is "a story about what happened in the future" (<http://www.forecastingprinciples.com/forecastingdictionary.html>).

Like theatre or performance art, scenarios are open to many styles of organization and implementation. Background information can be conveyed by oral presentation or by multimedia documents. Participants may represent themselves, or they may act as exemplars of their professional role, or they may play some other type of person entirely.

Three major trends that we thought would have the biggest impact on the web:

- (i) **Augmented Reality:** The gap is closing between the Web and the world. Services that know where you are and adapt accordingly will become commonplace. The web becomes fully integrated into every physical environment.
- (ii) **Data Abundance:** There's more data available to us all the time—both the data we produce intentionally and the data we throw off as a by-product of other activities. The web will play a key role in how people access, manage, and make sense of all that data.
- (iii) **Virtual Identity:** People are increasingly expected to have a digital presence as well as a physical one. We inhabit spaces online, but we also create them through our personal expression and participation in the digital realm(10)

Scenario planning is flexible enough to be included in other prediction methods. In the Delphi method, for example, the Pew/Elon report asked respondents to imagine scenarios of possible technological systems. In prediction markets, the possible outcomes for each proposition could be considered mini-scenarios.

VI OTHER CHALLENGES

Futurological methods are still, at best, partial works in progress. No method has yet succeeded in accurately predicting the future. One challenge to any futures method is the sheer complexity of the future. The present-day world is teeming with multiple and ramifying details. These are rendered

into a higher order of complexity when advanced in the stream of time. The methods discussed above try to solve this problem by abstracting the details into simpler shapes or by isolating the details out from larger backgrounds.

Another challenge to futurism is the "unknown unknown," a recently coined phrase so resonant as to spawn a slang contraction: "unk-unk."⁽¹¹⁾ Ultimately, it is impossible to imagine a development that we don't know exists or don't know is about to emerge. We can imagine possibilities, from jetpacks to fast interstellar travel to a generally accepted solution to copyright problems. But new *categories* of technologies, new types we aren't even thinking of, are sometimes precisely the ones that erupt most noisily.

Perhaps the best answer to the question of whether we should attempt to apprehend the future is that doing so prepares us for events when they occur. The intellectual exercise of working through options and possibilities stretches our personal and institutional horizons, building intelligence and flexibility. Just as learning how to use one tool prepares us to better grasp the next, similar tool, thinking through different hypothetical scenarios and trends helps us know how to react to and take advantage of the ones that actually cross over the horizon.

VII CONCLUSION

Technology development has yet to slow down, and the use of electronic devices continues to grow nearly past our ability to keep up. The complexity of what is described only increases over the years. New pedagogical and scholarly forms appear. Already established products and platforms morph. Practices change in spite of, or because of, financial problems.

That complexity demands non-simple responses. Each of the techniques sketched above offers one way of helping groups to think through these emergent forces and to apprehend the future. Crowdsourcing, scenarios, prediction markets, the Delphi method, and environmental scanning are complementary strategies. Using several of these methods can teach us to learn about the future in more sophisticated, pro-active ways. If the methods appear strange, resembling science fiction, perhaps that is a sign of their aptness for the future, since the future often appears strange just before it becomes ordinary—or, in our case, just before it becomes a campus reality. As higher education budgets clamp down and the future hurtles toward us, we need these methods and techniques as allies that can help us to survive . . . and to learn.

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- [11] Made famous by former U.S. Secretary of Defense Donald Rumsfeld in 2002, the phrase "unknown unknowns" was originally used in the field of engineering (see, for example, the definition in the *Double-Tongued Dictionary*: <http://www.doubletongued.org/index.php/dictionary/unk_unk/>).