Pew Internet
Pew Internet & American Life Project

Future of the Internet IV

Experts and stakeholders discuss predictions about the future of the internet. Update: Correction.

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Overview

Overview of responses

In an online survey of 895 technology stakeholders' and critics' expectations of social, political and economic change by 2020, fielded by the Pew Research Center's Internet & American Life Project and Elon University's Imagining the Internet Center:

» **Google won't make us stupid:** 76% of these experts agreed with the statement, "By 2020, people's use of the Internet has enhanced human intelligence; as people are allowed unprecedented access to more information they become smarter and make better choices. Nicholas Carr was wrong: Google does not make us stupid." Some of the best answers are in Part 1 of this report.

» **Reading, writing, and the rendering of knowledge will be improved:** 65% agreed with the statement "by 2020 it will be clear that the Internet has enhanced and improved reading, writing and the rendering of knowledge." Still, 32% of the respondents expressed concerns that by 2020 "it will be clear that the Internet has diminished and endangered reading, writing and the rendering of knowledge." Some of the best answers are in Part 2 of this report.

» **Innovation will continue to catch us by surprise:** 80% of the experts agreed that the "hot gadgets and applications that will capture the imaginations of users in 2020 will often come 'out of the blue.'" Some of the best answers are in Part 3 of this report.

» **Respondents hope information will flow relatively freely online, though there will be flashpoints over control of the internet.** Concerns over control of the Internet were expressed in answers to a question about the end-to-end principle. 61%

responded that the Internet will remain as its founders envisioned, however many who agreed with the statement that "most disagreements over the way information flows online will be resolved in favor of a minimum number of restrictions" also noted that their response was a "hope" and not necessarily their true expectation. 33% chose to agree with the statement that "the Internet will mostly become a technology where intermediary institutions that control the architecture and ...content will be successful in gaining the right to manage information and the method by which people access it." Some of the best answers are in Part 4 of this report.

» **Anonymous online activity will be challenged, though a modest majority still think it will possible in 2020:** There more of a split verdict among the expert respondents about the fate on online anonymity. Some 55% agreed that Internet users will still be able to communicate anonymously, while 41% agreed that by 2020 "anonymous online activity is sharply curtailed." Some of the best answers are in Part 5 of this report.

Survey method

'Tension pairs' were designed to provoke detailed elaborations

This is the fourth "Future of the Internet" survey conducted by the Pew Internet & American Life Project and Elon University's Imagining the Internet Center. The surveys are conducted through online questionnaires to which a selected group of experts and the highly engaged Internet public have been invited to respond. The surveys present potential-future scenarios to which respondents react with their expectations based on current knowledge and attitudes. You can view detailed results from the first three surveys here: http://pewinternet.org/topics/Future-of-the-internet.aspx and http://elon.edu/e-web/predictions/expertsurveys/default.xhtml. Expanded results are published in the "Future of the Internet" series published by Cambria Press.

Respondents to the Future of the Internet IV survey, fielded from Dec. 2, 2009 to Jan. 11, 2010, were asked to consider the future of the Internet-connected world between now and 2020 and the likely innovation that will occur. They were asked to assess 10 different "tension pairs" – each pair offering two different 2020 scenarios with the same overall theme and opposite outcomes – and they were asked to select the one most likely choice of two statements. The tension pairs and their alternative outcomes were constructed to reflect previous statements about the likely evolution of the Internet. They were reviewed and edited by the Pew Internet Advisory Board.

Please note that this survey is primarily focused on eliciting focused observations on the likely impact and influence of the Internet – not on the respondents' choices from the pairs of predictive statements. Many times when respondents "voted" for one scenario over another, they responded in their elaboration that both outcomes are likely to a degree or that an outcome not offered would be their true choice. Survey participants were informed that "it is likely you will struggle with most or all of the choices and some may be impossible to decide; we hope that will inspire you to write responses that will

explain your answer and illuminate important issues."

Experts were located in two ways. First, several thousand were identified in an extensive canvassing of scholarly, government, and business documents from the period 1990-1995 to see who had ventured predictions about the future impact of the Internet. Several hundred of them participated in the first three surveys conducted by Pew Internet and Elon University, and they were recontacted for this survey. Second, expert participants were hand-picked due to their positions as stakeholders in the development of the Internet.

Here are some of the respondents: Clay Shirky, Esther Dyson, Doc Searls, Nicholas Carr, Susan Crawford, David Clark, Jamais Cascio, Peter Norvig, Craig Newmark, Hal Varian, Howard Rheingold, Andreas Kluth, Jeff Jarvis, Andy Oram, David Sifry, Marc Rotenberg, John Pike, Andrew Nachison, Anthony Townsend, Ethan Zuckerman, Stephen Downes, Rebecca MacKinnon, Jim Warren, Sandra Brahman, Seth Finkelstein, Jerry Berman, and Stewart Baker.

Here are some of the institutions in which respondents work or have affiliations: Google, Microsoft. Cisco Systems, Yahoo!, Intel, IBM, Hewlett-Packard, Ericsson Research, Nokia, New York Times, O'Reilly Media, Thomson Reuters, Wired magazine, The Economist magazine, NBC, RAND Corporation, Verizon Communications, Linden Lab, Institute for the Future, British Telecom, Qwest Communications, Raytheon, Adobe, Meetup, Craigslist, Ask.com, Intuit, MITRE Corporation

Department of Defense, Department of State, Federal Communications Commission, Department of Health and Human Services, Centers for Disease Control and Prevention, Social Security Administration, General Services Administration, British OfCom, World Wide Web Consortium, National Geographic Society, Benton Foundation, Linux Foundation, Association of Internet Researchers, Internet2, Internet Society, Santa Fe Institute, Yankee Group

Harvard University, MIT, Yale University, Georgetown University, Oxford Internet Institute, Princeton University, Carnegie-Mellon University, University of Pennsylvania, University of California-Berkeley, Columbia University, University of Southern California, Cornell University, University of North Carolina, Purdue University, Duke University , Syracuse University, New York University, Northwestern University, Ohio University ,Georgia Institute of Technology, Florida State University, University of Kentucky, University of Texas, University of Maryland, University of Kansas, University of Illinois, Boston College, University of Tulsa, University of Minnesota, Arizona State, Michigan State University, University of California-Irvine, George Mason University, University of Utah, Ball State University, Baylor University, University of Massachusetts-Amberst, University of Georgia, Williams College, and University of Florida.

While many respondents are at the pinnacle of Internet leadership, some of the survey respondents are "working in the trenches" of building the Web. Most of the people in this latter segment of responders came to the survey by invitation because they are on the email list of the Pew Internet & American Life Project or are otherwise known to the Project. They are not necessarily opinion leaders for their industries or well-known futurists, but it is striking how much their views were distributed in ways that paralleled those who are celebrated in the technology field.

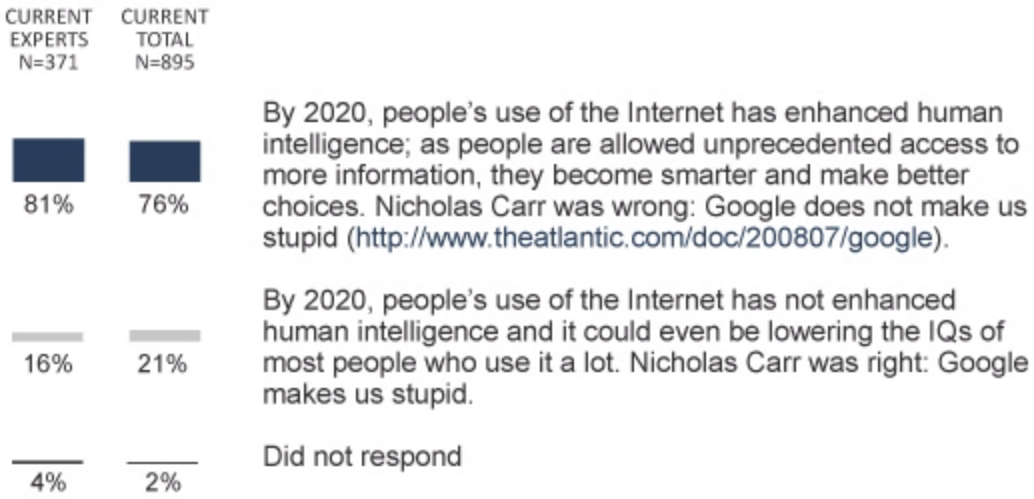
A wide range of opinion from experts, organizations, and interested institutions was sought, this survey should not be taken as a representative canvassing of Internet experts. By design, this survey was an "opt in," self-selecting effort. That process does not yield a random, representative sample. The quantitative results are based on a non-random online sample of 895 Internet experts and other Internet users, recruited by email invitation, Twitter or Facebook. Since the data are based on a non-random sample, a margin of error cannot be computed, and results are not projectable to any population other than the respondents in this sample.

Many of the respondents are Internet veterans – 50% have been using the Internet since 1992 or earlier, with 11 percent actively involved online since 1982 or earlier. When asked for their primary area of Internet interest, 15% of the survey participants identified themselves as research scientists; 14% as business leaders or entrepreneurs; 12% as consultants or futurists, 12% as authors, editors or journalists; 9% as technology developers or administrators; 7% as advocates or activist users; 3% as pioneers or originators; 2% as legislators, politicians or lawyers; and 25 percent specified their primary area of interest as "other." Results are divided into a column for invited experts only and a column that combines experts with general public.

The answers these respondents gave to the questions are given in two columns. The first column covers the answers of 371 longtime experts who have regularly participated in these surveys. The second column covers the answers of all the respondents, including the 524 who were recruited by other experts or by their association with the Pew Internet Project. Interestingly, there is not great variance between the smaller and bigger pools of respondents.

Part 1: A review of responses to a tension pair about whether Google will make people stupid.

The future of intelligence



Eminent tech scholar and analyst Nicholas Carr wrote a provocative cover story for the Atlantic Monthly magazine in the summer of 2008[1] with the cover line: "Is Google Making us Stupid?" He argued that the ease of online searching and distractions of browsing through the web were possibly limiting his capacity to concentrate. "I'm not thinking the way I used to," he wrote, in part because he is becoming a skimming, browsing reader, rather than a deep and engaged reader. "The kind of deep reading that a sequence of printed pages promotes is valuable not just for the knowledge we acquire from the author's words but for the intellectual vibrations those words set off within our own minds. In the quiet spaces opened up by the sustained, undistracted reading of a book, or by any other act of contemplation, for that matter, we make our own associations, draw our own inferences and analogies, foster our own ideas…. If we lose those quiet spaces, or fill them up with 'content,' we will sacrifice something important not only in our selves but in our culture."

Jamais Cascio, an affiliate at the Institute for the Future and senior fellow at the

Institute for Ethics and Emerging Technologies, challenged Carr in a subsequent article in the Atlantic Monthly (http://www.theatlantic.com/doc/200907/intelligence). Cascio made the case that the array of problems facing humanity -- the end of the fossil-fuel era, the fragility of the global food web, growing population density, and the spread of pandemics, among others – will force us to get smarter if we are to survive. "Most people don't realize that this process is already under way," he wrote. "In fact, it's happening all around us, across the full spectrum of how we understand intelligence. It's visible in the hive mind of the Internet, in the powerful tools for simulation and visualization that are jump-starting new scientific disciplines, and in the development of drugs that some people (myself included) have discovered let them study harder, focus better, and stay awake longer with full clarity." He argued that while the proliferation of technology and media can challenge humans' capacity to concentrate there were signs that we are developing "fluid intelligence—the ability to find meaning in confusion and solve new problems, independent of acquired knowledge." He also expressed hope that techies will develop tools to help people find and assess information smartly.

With that as backdrop, respondents were asked to explain their answer to the tension pair statements and "share your view of the Internet's influence on the future of human intelligence in 2020 – what is likely to stay the same and what will be different in the way human intellect evolves?" What follows is a selection of the hundreds of written elaborations and some of the recurring themes in those answers:

Nicholas Carr and Google staffers have their say

"I feel compelled to agree with myself. But I would add that the Net's effect on our intellectual lives will not be measured simply by average IQ scores. What the Net does is shift the emphasis of our intelligence, away from what might be called a meditative or contemplative intelligence and more toward what might be called a utilitarian intelligence. The price of zipping among lots of bits of information is a loss of depth in our thinking."– **Nicholas Carr**

"My conclusion is that when the only information on a topic is a handful of essays or books, the best strategy is to read these works with total concentration. But when you have access to thousands of articles, blogs, videos, and people with expertise on the topic, a good strategy is to skim first to get an overview. Skimming and concentrating can and should coexist. I would also like to say that Carr has it mostly backwards when he says that Google is built on the principles of Taylorism [the institution of time-management and worker-activity standards in industrial settings]. Taylorism shifts responsibility from worker to management, institutes a standard method for each job, and selects workers with skills unique for a specific job. Google does the opposite, shifting responsibility from management to the worker, encouraging creativity in each job, and encouraging workers to shift among many different roles in their career….Carr is of course right that Google thrives on understanding data. But making sense of data (both for Google internally and for its users) is not like building the same artifact over and over on an assembly line; rather it requires creativity, a mix of broad and deep knowledge, and a host of connections to other people. That is what Google is trying to facilitate." – **Peter Norvig,** Google Research Director

"Google will make us more informed. The smartest person in the world could well be behind a plow in China or India. Providing universal access to information will allow such people to realize their full potential, providing benefits to the entire world." – **Hal Varian,** Google, chief economist

The resources of the internet and search engines will shift cognitive capacities. We won't have to remember as much, but we'll have to think harder and have better critical thinking and analytical skills. Less time devoted to memorization gives people more time to master those new skills.

"Google allows us to be more creative in approaching problems and more integrative in our thinking. We spend less time trying to recall and more time generating solutions." – **Paul Jones**, ibiblio, University of North Carolina – Chapel Hill

“Google will make us stupid and intelligent at the same time. In the future, we will live in a transparent 3D mobile media cloud that surrounds us everywhere. In this cloud, we will use intelligent machines, to whom we delegate both simple and complex tasks. Therefore, we will loose the skills we needed in the old days (e.g., reading paper maps while driving a car). But we will gain the skill to make better choices (e.g., knowing to choose the mortgage that is best for you instead of best for the bank). All in all, I think the gains outweigh the losses.” -- **Marcel Bullinga**, Dutch Futurist at futurecheck.com

“I think that certain tasks will be “offloaded” to Google or other Internet services rather than performed in the mind, especially remembering minor details. But really, that a role that paper has taken over many centuries: did Gutenberg make us stupid? On the other hand, the Internet is likely to be front-and-centre in any developments related to improvements in neuroscience and human cognition research.” – **Dean Bubley,** wireless industry consultant

“What the internet (here subsumed tongue-in-cheek under “Google”) does is to support SOME parts of human intelligence, such as analysis, by REPLACING other parts such as memory. Thus, people will be more intelligent about, say, the logistics of moving around a geography because “Google” will remember the facts and relationships of various locations on their behalf. People will be better able to compare the revolutions of 1848 and 1789 because “Google” will remind them of all the details as needed. This is the continuation ad infinitum of the process launched by abacuses and calculators: we have become more “stupid” by losing our arithmetic skills but more intelligent at evaluating numbers.” – **Andreas Kluth,** writer, Economist magazine

“It's a mistake to treat intelligence as an undifferentiated whole. No doubt we will become worse at doing some things ('more stupid') requiring rote memory of information that is now available though Google. But with this capacity freed, we may (and probably will) be capable of more advanced integration and evaluation of information ('more intelligent').” – **Stephen Downes,** National Research Council,

Canada

"The new learning system, more informal perhaps than formal, will eventually win since we must use technology to cause everyone to learn more, more economically and faster if everyone is to be economically productive and prosperous. Maintaining the status quo will only continue the existing win/lose society that we have with those who can learn in present school structure doing ok, while more and more students drop out, learn less, and fail to find a productive niche in the future." – **Ed Lyell**, former member of the Colorado State Board of Education and Telecommunication Advisory Commission

"The question is flawed: Google will make intelligence different. As Carr himself suggests, Plato argued that reading and writing would make us stupid, and from the perspective of a preliterate, he was correct. Holding in your head information that is easily discoverable on Google will no longer be a mark of intelligence, but a side-show act. Being able to quickly and effectively discover information and solve problems, rather than do it "in your head," will be the metric we use." – **Alex Halavais**, vice president, Association of Internet Researchers

"What Google does do is simply to enable us to shift certain tasks to the network - we no longer need to rote-learn certain seldomly-used facts (the periodic table, the post code of Ballarat) if they're only a search away, for example. That's problematic, of course - we put an awful amount of trust in places such as Wikipedia where such information is stored, and in search engines like Google through which we retrieve it - but it doesn't make us stupid, any more than having access to a library (or in fact, access to writing) makes us stupid. That said, I don't know that the reverse is true, either: Google and the Net also don't automatically make us smarter. By 2020, we will have even more access to even more information, using even more sophisticated search and retrieval tools - but how smartly we can make use of this potential depends on whether our media literacies and capacities have caught up, too." – **Axel Bruns,** Associate Professor, Queensland University of Technology

"My ability to do mental arithmetic is worse than my grandfathers because I grew up in an era with pervasive personal calculators…. I am not stupid compared to my grandfather, but I believe the development of my brain has been changed by the availability of technology. The same will happen (or is happening) as a result of the Googleization of knowledge. People are becoming used to bite sized chunks of information that are compiled and sorted by an algorithm. This must be having an impact on our brains, but it is too simplistic to say that we are becoming stupid as a result of Google." – **Robert Acklund,** Australian National University

"We become adept at using useful tools, and hence perfect new skills. Other skills may diminish. I agree with Carr that we may on the average become less patient, less willing to read through a long, linear text, but we may also become more adept at dealing with multiple factors…. Note that I said 'less patient,' which is not the same as 'lower IQ.' I suspect that emotional and personality changes will probably more marked than 'intelligence' changes." – **Larry Press,** California State University, Dominguz Hills

Technology isn't the problem here. It is people's inherent character traits. The internet and search engines just enable people to be more of what they already are. If they are motivated to learn and shrewd, they will use new tools to explore in exciting new ways. If they are lazy or incapable of concentrating, they will find new ways to be distracted and goof off.

"The question is all about people's choices. If we value introspection as a road to insight, if we believe that long experience with issues contributes to good judgment on those issues, if we (in short) want knowledge that search engines don't give us, we'll maintain our depth of thinking and Google will only enhance it. There is a trend, of course, toward instant analysis and knee-jerk responses to events that degrades a lot of writing and discussion. We can't blame search engines for that…. What search engines do is provide more information, which we can use either to become dilettantes (Carr's worry) or to bolster our knowledge around the edges and do fact-checking while we rely mostly

on information we've gained in more robust ways for our core analyses. Google frees the time we used to spend pulling together the last 10% of facts we need to complete our research. I read Carr's article when The Atlantic first published it, but I used a web search to pull it back up and review it before writing this response. Google is my friend." – **Andy Oram**, editor and blogger, O'Reilly Media

"For people who are readers and who are willing to explore new sources and new arguments, we can only be made better by the kinds of searches we will be able to do. Of course, the kind of Googled future that I am concerned about is the one in which my every desire is anticipated, and my every fear avoided by my guardian Google. Even then, I might not be stupid, just not terribly interesting." – **Oscar Gandy,** emeritus professor, University of Pennsylvania

"I don't think having access to information can ever make anyone stupider. I don't think an adult's IQ can be influenced much either way by reading anything and I would guess that smart people will use the Internet for smart things and stupid people will use it for stupid things in the same way that smart people read literature and stupid people read crap fiction. On the whole, having easy access to more information will make society as a group smarter though." – **Sandra Kelly,** market researcher, 3M Corporation

"The story of humankind is that of work substitution and human enhancement. The Neolithic revolution brought the substitution of some human physical work by animal work. The Industrial revolution brought more substitution of human physical work by machine work. The Digital revolution is implying a significant substitution of human brain work by computers and ICTs in general. Whenever a substitution has taken place, men have been able to focus on more qualitative tasks, entering a virtuous cycle: the more qualitative the tasks, the more his intelligence develops; and the more intelligent he gets, more qualitative tasks he can perform…. As obesity might be the side-effect of physical work substitution my machines, mental laziness can become the watermark of mental work substitution by computers, thus having a negative effect instead of a

positive one." – **Ismael Peña-Lopez**, lecturer at the Open University of Catalonia, School of Law and Political Science

"Well, of course, it depends on what one means by 'stupid' -- I imagine that Google, and its as yet unimaginable new features and capabilities will both improve and decrease some of our human capabilities. Certainly it's much easier to find out stuff, including historical, accurate, and true stuff, as well as entertaining, ironic, and creative stuff. It's also making some folks lazier, less concerned about investing in the time and energy to arrive at conclusions, etc." – **Ron Rice,** University of California, Santa Barbara

"Nick [Carr] says, 'Once I was a scuba diver in the sea of words. Now I zip along the surface like a guy on a Jet Ski.' Besides finding that a little hard to believe (I know Nick to be a deep diver, still), there is nothing about Google, or the Net, to keep anyone from diving — and to depths that were not reachable before the Net came along."– **Doc Searls**, co-author of "The Cluetrain Manifesto"

"Google isn't making us stupid - but it is making many of us intellectually lazy. This has already become a big problem in university classrooms. For my undergrad majors in Communication Studies, Google may take over the hard work involved in finding good source material for written assignments. Unless pushed in the right direction, students will opt for the top 10 or 15 hits as their research strategy. And it's the students most in need of research training who are the least likely to avail themselves of more sophisticated tools like Google Scholar. Like other major technologies, Google's search functionality won't push the human intellect in one predetermined direction. It will reinforce certain dispositions in the end-user: stronger intellects will use Google as a creative tool, while others will let Google do the thinking for them." – **David Ellis,** York University, Toronto

It's not Google's fault if users create stupid queries.

"To be more precise, unthinking use of the Internet, and in particular untutored use of Google, has the ability to make us stupid, but that is not a foregone conclusion. More and more of us experience attention deficit, like Bruce Friedman in the Nicholas Carr article, but that alone does not stop us making good choices provided that the "factoids" of information are sound that we use to make out decisions. The potential for stupidity comes where we rely on Google (or Yahoo, or Bing, or any engine) to provide relevant information in response to poorly constructed queries, frequently one-word queries, and then base decisions or conclusions on those returned items." – **Peter Griffiths,** former Head of Information at the Home Office within the Office of the Chief Information Officer, United Kingdom

"The problem isn't Google; it's what Google helps us find. For some, Google will let them find useless content that does not challenge their minds. But for others, Google will lead them to expect answers to questions, to explore the world, to see and think for themselves." – **Esther Dyson**, longtime Internet expert and investor

"People are already using Google as an adjunct to their own memory. For example, I have a hunch about something, need facts to support, and Google comes through for me. Sometimes, I see I'm wrong, and I appreciate finding that out before I open my mouth." – **Craig Newmark,** founder Craig's List

"Google is a data access tool. Not all of that data is useful or correct. I suspect the amount of misleading data is increasing faster than the amount of correct data. There should also be a distinction made between data and information. Data is meaningless in the absence of an organizing context. That means that different people looking at the same data are likely to come to different conclusions. There is a big difference with what a world class artist can do with a paint brush as opposed to a monkey. In other words, the value of Google will depend on what the user brings to the game. The value of data is highly dependent on the quality of the question being asked." – **Robert Lunn,** consultant, FocalPoint Analytics

The big struggle is over what kind of information Google and other search engines kick back to users. In the age of social media where users can be their own content creators it might get harder and harder to separate high-quality material from junk.

"Access to more information isn't enough -- the information needs to be correct, timely, and presented in a manner that enables the reader to learn from it. The current network is full of inaccurate, misleading, and biased information that often crowds out the valid information. People have not learned that 'popular' or 'available' information is not necessarily valid."– **Gene Spafford**, Purdue University CERIAS, Association for Computing Machinery U.S. Public Policy Council

"If we take 'Google' to mean the complex social, economic and cultural phenomenon that is a massively interactive search and retrieval information system used by people and yet also using them to generate its data, I think Google will, at the very least, not make us smarter and probably will make us more stupid in the sense of being reliant on crude, generalised approximations of truth and information finding. Where the questions are easy, Google will therefore help; where the questions are complex, we will flounder." – **Matt Allen,** former president of the Association of Internet Researchers and associate professor of internet studies at Curtin University in Australia

"The challenge is in separating that wheat from the chaff, as it always has been with any other source of mass information, which has been the case all the way back to ancient institutions like libraries. Those users (of Google, cable TV, or libraries) who can do so efficiently will beat the odds, becoming 'smarter' and making better choices. However, the unfortunately majority will continue to remain, as Carr says, stupid." – **Christopher Saunders,** managing editor internetnews.com

"The problem with Google that is lurking just under the clean design home page is the "tragedy of the commons": the link quality seems to go down every year. The link

quality may actually not be going down but the signal to noise is getting worse as commercial schemes lead to more and more junk links." – **Glen Edens,** former senior vice president and director at Sun Microsystems Laboratories, chief scientist Hewlett Packard

Literary intelligence is very much under threat.

"If one defines -- or partially defines -- IQ as literary intelligence, the ability to sit with a piece of textual material and analyze it for complex meaning and retain derived knowledge, then we are indeed in trouble. Literary culture is in trouble…. We are spending less time reading books, but the amount of pure information that we produce as a civilization continues to expand exponentially. That these trends are linked, that the rise of the latter is causing the decline of the former, is not impossible…. One could draw reassurance from today's vibrant Web culture if the general surfing public, which is becoming more at home in this new medium, displayed a growing propensity for literate, critical thought. But take a careful look at the many blogs, post comments, Facebook pages, and online conversations that characterize today's Web 2.0 environment…. This type of content generation, this method of 'writing,' is not only sub-literate, it may actually undermine the literary impulse…. Hours spent texting and e-mailing, according to this view, do not translate into improved writing or reading skills." – **Patrick Tucker,** senior editor, The Futurist magazine

New literacies will be required to function in this world. In fact, the internet might change the very notion of what it means to be smart. Retrieval of good information will be prized. Maybe a race of "extreme Googlers" will come into being.

"The critical uncertainty here is whether people will learn and be taught the essential literacies necessary for thriving in the current infosphere: attention, participation, collaboration, crap detection, and network awareness are the ones I'm concentrating on. I have no reason to believe that people will be any less credulous, gullible, lazy, or

prejudiced in ten years, and am not optimistic about the rate of change in our education systems, but it is clear to me that people are not going to be smarter without learning the ropes." – **Howard Rheingold,** author of several prominent books on technology, teacher at Stanford University and University of California-Berkeley

"Google makes us simultaneously smarter and stupider. Got a question? With instant access to practically every piece of information ever known to humankind, we take for granted we're only a quick web search away from the answer. Of course, that doesn't mean we understand it. In the coming years we will have to continue to teach people to think critically so they can better understand the wealth of information available to them." -- **Jeska Dzwigalski**, Linden Lab

"We might imagine that in ten years, our definition of intelligence will look very different. By then, we might agree on "smart" as something like a 'networked' or 'distributed' intelligence where knowledge is our ability to piece together various and disparate bits of information into coherent and novel forms." – **Christine Greenhow,** educational researcher, University of Minnesota and Yale Information and Society Project

"Human intellect will shift from the ability to retain knowledge towards the skills to discover the information i.e. a race of extreme Googlers (or whatever discovery tools come next). The world of information technology will be dominated by the algorithm designers and their librarian cohorts. Of course, the information they're searching has to be right in the first place. And who decides that?" – **Sam Michel,** founder Chinwag, community for digital media practitioners in the United Kingdom

One new "literacy" that might help is the capacity to build and use social networks to help people solve problems.

"There's no doubt that the internet is an extension of human intelligence, both individual

and collective. But the extent to which it's able to augment intelligence depends on how much people are able to make it conform to their needs. Being able to look up who starred in the 2nd season of the Tracey Ullman show on Wikipedia is the lowest form of intelligence augmentation; being able to build social networks and interactive software that helps you answer specific questions or enrich your intellectual life is much more powerful. This will matter even more as the internet becomes more pervasive. Already my iPhone functions as the external, silicon lobe of my brain. For it to help me become even smarter, it will need to be even more effective and flexible than it already is. What worries me is that device manufacturers and internet developers are more concerned with lock-in than they are with making people smarter. That means it will be a constant struggle for individuals to reclaim their intelligence from the networks they increasingly depend upon." – **Dylan Tweney,** senior editor, Wired magazine

Nothing can be bad that delivers more information to people, more efficiently. It might be that some people lose their way in this world, but overall, societies will be substantially smarter.

"The Internet has facilitated orders of magnitude improvements in access to information. People now answer questions in a few moments that a couple of decades back they would not have bothered to ask, since getting the answer would have been impossibly difficult." – **John Pike,** Director, globalsecurity.org

"Google is simply one step, albeit a major one, in the continuing continuum of how technology changes our generation and use of data, information, and knowledge that has been evolving for decades. As the data and information goes digital and new information is created, which is at an ever increasing rate, the resultant ability to evaluate, distill, coordinate, collaborate, problem solve only increases along a similar line. Where it may appear a 'dumbing down' has occurred on one hand, it is offset (I believe in multiples) by how we learn in new ways to learn, generate new knowledge, problem solve, and innovate." -- **Mario Morino,** Chairman, Venture Philanthropy Partners

Google itself and other search technologies will get better over time and that will help solve problems created by too-much-information and too-much-distraction.

"I'm optimistic that Google will get smarter by 2020 or will be replaced by a utility that is far better than Google. That tool will allow queries to trigger chains of high-quality information - much closer to knowledge than flood. Humans who are able to access these chains in high-speed, immersive ways will have more patters available to them that will aid decision-making. All of this optimism will only work out if the battle for the soul of the Internet is won by the right people - the people who believe that open, fast, networks are good for all of us." – **Susan Crawford**, former member of President Obama's National Economic Council, now on the law faculty at the University of Michigan

"If I am using Google to find an answer, it is very likely the answer I find will be on a message board in which other humans are collaboratively debating answers to questions. I will have to choose between the answer I like the best. Or it will force me to do more research to find more information. Google never breeds passivity or stupidity in me: It catalyzes me to explore further. And along the way I bump into more humans, more ideas and more answers." – **Joshua Fouts,** Senior Fellow for Digital Media & Public Policy at the Center for the Study of the Presidency

The more we use the internet and search, the more dependent on it we will become.

"As the Internet gets more sophisticated it will enable a greater sense of empowerment among users. We will not be more stupid, but we will probably be more dependent upon it." – **Bernie Hogan,** Oxford Internet Institute

Even in little ways, including in dinner table chitchat, Google can make people smarter.

"[Family dinner conversations] have changed markedly because we can now look things up at will. That's just one small piece of evidence I see that having Google at hand is great for civilization." – **Jerry Michalski**, president, Sociate

'We know more than ever, and this makes us crazy.'

"The answer is really: both. Google has already made us smarter, able to make faster choices from more information. Children, to say nothing of adults, scientists and professionals in virtually every field, can seek and discover knowledge in ways and with scope and scale that was unfathomable before Google. Google has undoubtedly expanded our access to knowledge that can be experienced on a screen, or even processed through algorithms, or mapped. Yet Google has also made us careless too, or stupid when, for instance, Google driving directions don't get us to the right place. It ahs confused and overwhelmed us with choices, and with sources that are not easily differentiated or verified. Perhaps it's even alienated us from the physical world itself - from knowledge and intelligence that comes from seeing, touching, hearing, breathing and tasting life. From looking into someone's eyes and having them look back into ours. Perhaps it's made us impatient, or shortened our attention spans, or diminished our ability to understand long thoughts. It's enlightened anxiety. We know more than ever, and this makes us crazy." – **Andrew Nachison,** co-founder, We Media

A final thought: Maybe Google won't make us more stupid, but it should make us more modest.

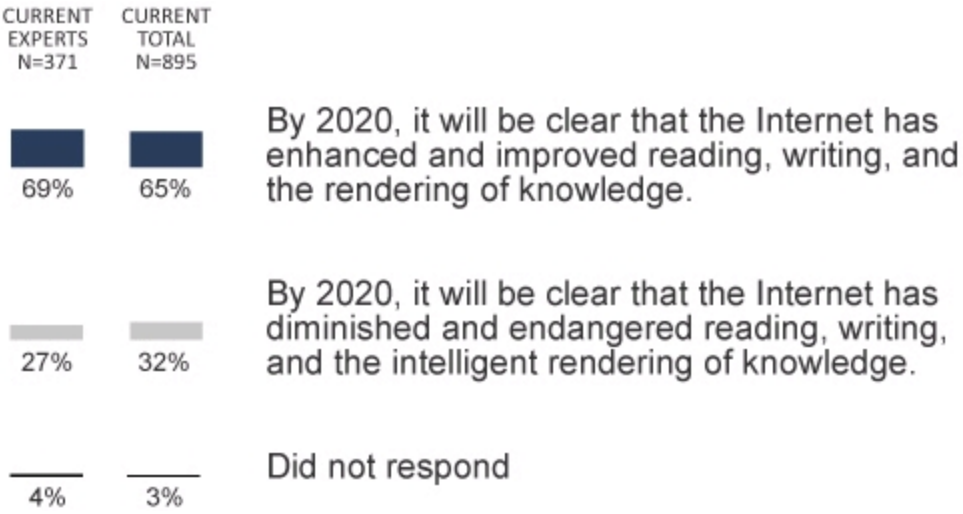
"There is and will be lots more to think about, and a lot more are thinking. No, not more stupid. Maybe more humble." -- **Sheizaf Rafaeli,** Center for the Study of the Information Society, University of Haifa

NOTES

[1] Note: Previously, this sentence had incorrectly stated that the article was published in the summer of 2009.

Part 2: A review of responses to a tension pair about the impact of the internet on reading, writing, and the rendering of knowledge

The future of books



Respondents were asked to explain their choice and "share your view of the Internet's influence on the future of knowledge-sharing in 2020, specifically when it comes to reading and writing and other displays of information – what is likely to stay the same and what will be different? What do you think is the future of books?"

Interestingly, people often replied to this question with personal stories about their own reading and writing habits. What follows is a selection of the hundreds of written elaborations and some of the recurring themes in those answers:

The evidence is pretty clear: The actual words that are being written in the world of texting and Tweeting are not so hot.

"Most writing online is devolving toward SMS and tweets that involve quick, throwaway notes with abbreviations and threaded references. This is not a form of lasting

communication. In 2020 there is unlikely to be a list of classic tweets and blog posts that every student and educated citizen should have read." – **Gene Spafford**, Purdue University CERIAS, Association for Computing Machinery U.S. Public Policy Council

"IMHO the bigger problem is the lack of critical thinking in the Information Age. What is presented online may not be correct but interpreted as such by the reader. Further, writing seems to take 2 distinct 'evolutions' - there is FORMAL writing used in reports and professional work, and the INFORMAL writing used in personal emails, IM, and social networking that would (or should) never cross over into the FORMAL category of writing. Right now it's debatable how much the latter has transgressed into the former --- as for me I cringe in such cases!" – **Richard Forno,** Software Engineering Institute, Carnegie Mellon University

Some kinds of expression will "lose." Others will "win."

"This is a distinction without a metric. I think long-form expressive fiction will suffer (though this suffering has been more or less constant since the invention of radio) while all numeric and graphic forms of rendering knowledge, from the creation and use of databases to all forms of visual display of data will be in a golden age, with ordinary non-fiction writing getting a modest boost. So, English majors lose, engineering wins, and what looks like an Up or Down question says more about the demographic of the answerer than any prediction of the future." – **Clay Shirky,** professor, Interactive Telecommunications Program, New York University

Reading and writing will be different in 10 years. Language has always evolved to embrace new realities and it is evolving now. There will be a new fluidity in media creation. Visual representations and story telling will be important in new ways, so "screen" literacy will emerge.

"I think the state of reading and writing will be *different* in ten years as a result of the

Internet. Languages evolve, and established practices for writing evolve; when books were hand-lettered by scribes, they were written very differently than they are now, but it's hard to make a case that the practice got "worse." The Internet and associated publishing tools -- blogs, Twitter, and the like -- may have an accelerating effect on those changes; the art of reading, writing, and rendering knowledge is likely to evolve more quickly than it has in the past, and there are some who would argue that that is a bad thing. I think it will be different; not better, not worse, but not the same." – **Rachel Smith,** vice president, New Media Consortium

"The Internet will drive a clear and probably irreversible shift from written media to visual media. Expressing ideas in the future will just as likely involve creating a simulation as writing an expository essay. Whether that will make our renderings of knowledge less intelligent is unclear, but I think its likely that there are tremendous opportunities to enhance it. For instance, would it be more intelligent to render our knowledge of politics in Ancient Egypt as a book-length essay or a realistic, interactive role-playing simulation?" – **Anthony Townsend,** research director, Institute for the Future

"When I was a boy, homework consisted of writing a paragraph. Now, youth writing paragraphs in a blink of an eye. They are mastering language only to reinvent it. They are using it in new forms. Tags. Labels. Acronyms. And the game becomes a written game of who can use written word most effectively. Reading, writing, and communicating will become much more fluid as youth are more engaged in the practice of these skills, and have a greater motivation to practice their skills." – **Robert Cannon,** senior counsel for internet law at Federal Communications Commission

"We are currently transitioning from reading mainly on paper to reading mainly on screens. As we do so, most of us read MORE, in terms of quantity (word count), but more promiscuously and in shorter intervals and with less dedication. As these habits take root, they corrupt our willingness to commit to long texts, as found in books or essays. We will be less patient and less able to concentrate on long-form texts. This will

result in a resurgence of short-form texts and story-telling, in 'Haiku-culture' replacing 'book-culture.'" – **Andreas Kluth,** writer, Economist magazine

The nature of writing has changed now, especially since so much of it takes place in public. The quality of the new material will get better over time, in part because these new social media creators will get feedback and learn. Today's changes parallel other historic changes that occurred when new technologies came on the scene.

"The internet has helped shift written communication from a private space to a public one. Not all manifestations of this shift are pleasant ones - we are discovering that many of the people who surround us are angry, partisan and ill-informed. But for the most part, we're experiencing the benefits of being encouraged to develop ideas and arguments in public. Shifting writing from private to public spaces, in the long run, will be beneficial for the spread of human knowledge." – **Ethan Zuckerman**, Global Voices

"The internet is clearly responsible for an explosion in content production. We must remember that these measures of evaluation are normative and shift over time - enhancement and improvement is relative. I firmly believe that more people than ever before will be afforded the opportunity to write and create, to find audiences, and engage in content-enhancing feedback loops that will enhance communication." – **Fred Stutzman,** School of Information and Library Science, University of North Carolina-Chapel Hill

"The printing press diminished reliance on oral history and myth, photography transformed the purpose of visual art, and music recording reduced the stock of amateur musicians. We are currently experience a similar mass shift to a new means of sense-making and knowledge transmission. Literacy is a historical construct that will continue, but in the context of new, pervasive norms that are only now emerging." – **Nathaniel James,** executive director, OneWebDay

"The internet generation is being exposed to text and media in unprecedented quantities, and more, is not just consuming this media, but producing it as well. Practice tells. The improvement will be especially dramatic and apparent because new readers will be compared primarily with the previous generation, the television generation, which for the most part did not read at all. Unfortunately, this improvement will be apparent only to the newly literate generation; the older generation will continue to complain that young people cannot read, despite evidence to the contrary. Moreover, it will be apparent by 2020 that a multi-literate society has developed, one that can communicate with ease through a variety of media, including art and photography, animation, video, games and simulations, as well as text and code." – **Stephen Downes,** National Research Council, Canada

"When writing itself appeared, philosophers feared that it would weaken memory and degrade intelligence. But it allowed for a great, albeit externalized memory and an enlarged, albeit shared intelligence. When printing came on the scene, scholars decried the new technology for propagating error and, as it were, for throwing pearls before swine. But printing expanded knowledge, not least because it could exactly reproduce texts and, more importantly, pictures and diagrams. And it made this knowledge more broadly available than every before. The Internet will have similar effects, with some losses but, on balance, more gains." – **Mark U. Edwards,** senior advisor to the Dean, Harvard University Divinity School

Links that allow people to jump from text to text and explore material further have changed the nature of reading and argumentation. Networked information has special qualities and can be better than the front-to-back linear kind of reading that people have usually done.

"The way we read and write is certainly changing. Spelling and grammar have gotten worse. People don't think things through or edit as much before publishing or sending as they once did. But on the other hand, the Internet has improved my Chinese reading

and writing ability. The hyperlink enables me to communicate in non-linear ways that adds layers of meaning to my writing that could not exist on paper. The fact that I can mix visuals, sound, and text when making an argument or telling a story often enhances the effectiveness of my work." – **Rebecca MacKinnon**, Princeton Center for Information Technology Policy

"The net IS improving individuals' access to substantive information - that REQUIRES the ability to read (and understand ;-). Even 'mo'bettah', it seems to have weaned some number of folks - especially those who are younger - from previous generations' fanatical addiction to unidirectional, 'other-controlled' televisions. But it has also fueled a blizzard of near-incoherent blather - that is ungrammatical, wildly misspelled, and often partially or totally false. The latter implies that folks may read more, but receive less [accurate!] 'knowledge' (information). Fortunately, much of the net - at least in its current mo'less open-access form - IS the fastest and most bodacious self-correcting information system in existence." – **Jim Warren,** longtime tech entrepreneur and activist

People are doing more reading and writing now and that *has* to be better than the alternative. The act of making media in the Web 2.0 world – and beyond – has to increase people's engagement with information and conveying it.

"More people are reading and writing, and in more ways, for more readers and other writers, than ever before, and the sum of all of it goes up every day." – **Doc Searls**, co-author of "The Cluetrain Manifesto"

"I think that a marginally greater number of people will be engaged in creating media--visual as well as text--and as a result, the overall literacy will increase. I also think that the practice of allusion will have a much shorter lead time." – **Alex Halavais,** , vice president, Association of Internet Researchers

“For heaven's sake. It's clear NOW that the internet has enhanced and improved reading, writing, and the rendering of knowledge. You have to know how to read, it encourages writing, and people can exchange knowledge. Don't confuse this with the business models behind serious publishing, encyclopedias, and universities. The future of books is tied into whether there is a social/business model that supports writing for intellectual content rather than as marketing brochures or advertising-bait.” – **Seth Finkelstein,** author of the Infothought blog, writer and programmer

“The internet is increasing the amount of reading and writing. That means there is more good writing, and more people reading the good writing. But, in accordance with Sturgeon's Law, 90% of internet writing will be crud, because 90% of everything is crud. So there will be more crud writing and reading as well.” – **Peter Norvig,** Google Research Director

“Reading and writing will increase as those using the internet and the wealth of information continue to be exposed to a wide view of vocabulary, word use, and contextual information. Grammar, vocabulary, and more will continue to improve, especially for those being brought up solely on the internet as the major reference and information/knowledge repository.” – **Kevin Novak,** World Wide Web Consortium, Chair E-GOV section

“We may lose our ability to write, in the literal sense that students are no longer taught penmanship. We will either type or print like 8 year olds. But I think even email stimulates the putting of ideas into writing. And while we may read only on electronic media, I think the book and the scholarly work will survive as important means both of transferring knowledge and of entertainment.” – **David Clark**, senior research scientist for the Next-Generation Internet, MIT professor

“The internet will definitely *develop* reading, writing and the rendering of knowledge. Most people read more and pretty much everybody writes more because of the internet.

The *quality* of this material may be lower - if measured in terms of grammar and spelling - but that's the wrong measurement." – **Hjalmar Gislason,** founder DataMarket, a marketplace for structured data

"It's popular to decry texting and lousy email drafting, but it's clear to me that people are writing and reading more than ever before because of the Internet. It's also clear to me that good writing is recognized and admired online. I don't think the advent of video will change that - people in a hurry for information still want to scan text instead of being subject to someone else's video habits. Presenting yourself these days requires having a written identity, and that will continue to be the case ten years from now." – **Susan Crawford,** former member of President Obama's National Economic Council, now on the law faculty at the University of Michigan

Material produced by crowds – like Wikipedia -- is a new kind of way to produce and share knowledge and challenging old models.

"There is a transformation in what how we acquire, use, disseminate and share knowledge, particularly in notions of participatory culture. Knowledge produced by individuals, with clear ownership of copyright and production, will have to share center stage with knowledge produced by the crowds, as in Wikipedia, but also in many other potential collaborations." – **Caroline Haythornthwaite,** professor in graduate school of Library and Information Science, University of Illinois at Urbana-Champaign

A fourth "R" will be added to the basic learned skills of "reading, 'ritin, ;'rithmatic": Retrieval. Maybe the ability to write computer code will be a necessary literacy. Maybe it will be the ability to write smart search queries.

"I used to bemoan the lost epistolary art however with the benefit of time I have come to understand that there is far greater benefit to an engaged/active consumption of media (as opposed to the passive consumption of the past). As media becomes more socialized and we are all required to be active consumers, producers etc. there is an

inherent need for us to have a heightened and enhanced comprehension, a concise and disciplined writing form and a more universal lens. As Udi Manber of Google extolled, the four R's will become reading, writing, arithmetic, and retrieval. The web will be that interactive mechanism that allows this improvement for these basic human skills." – **Brian O'Shaughnessy,** director of communications, Skype

"This one is clear to me. Reading, writing, and the rendering of knowledge will improve -- but will people be equipped to separate the crap from the accurate information? That's a critical uncertainty." – **Howard Rheingold,** author of several prominent books on technology, teacher at Stanford University and University of California-Berkeley

"The kind of literacy gained by exposure to technology and the internet is becoming increasingly necessary and nuanced, but not in ways that will likely please grammaticians. Instead, the rules of languages are being rewritten by what our devices facilitate and make easy — from being able to achieve spelling proficiency by relying on spellcheck to inventing entirely new syntax for presenting a message (from emoticons to hashtags). One question is whether code will become a form of literature unto itself. While it seems the provenance of engineers and developers today, nothing is to say that making it through high school won't require fluency in HTML or JavaScript rather than French (remember, Google will translate for you in real-time). And if code is one of the most direct means to express an idea, perhaps it will become a unifying, albeit fairly unromantic, language of the ages." – **Chris Messina,** CEO, Citizen Agency, internet consultancy

"We will redefine what we mean by reading, writing, and the rendering of knowledge. Writing may be making videos. Reading may be parsing data or constructing better queries. How we teach the skills of acquiring, analyzing, and sharing information will have to change." – **Jeff Jarvis,** prominent blogger, professor, City University of New York Graduate School of Journalism

By 2020, we will have entered a "post literacy" era.

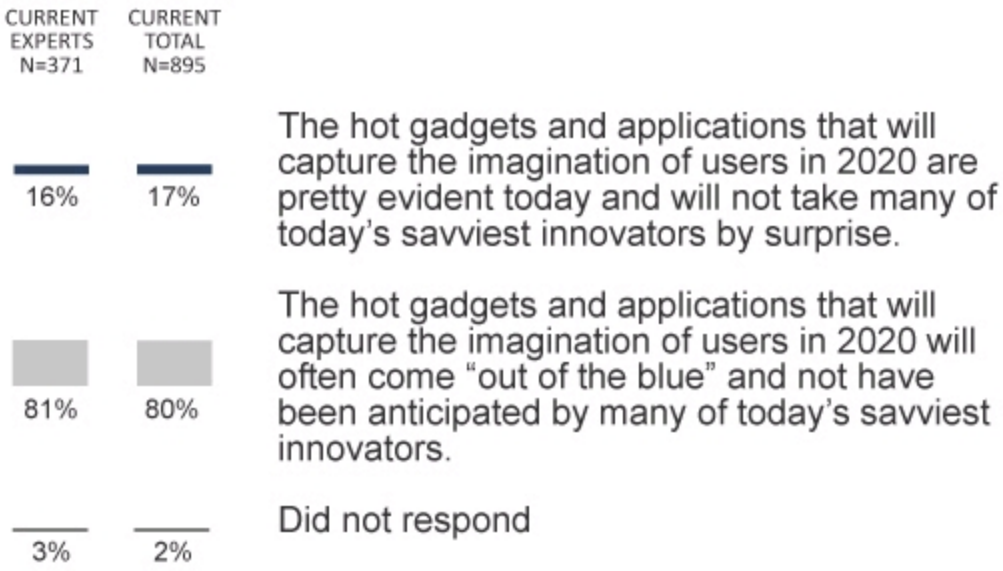
"In 2020 we will have entered post literacy era. With everything "smart" and information constantly available, reading and writing took on new dimensions in their place of human skills. Problem solving and reasoning became more important. Reading and writing more largely replaced by voice in- voice out types of interactions. Instantaneous language translation at higher levels of accuracy than could be attained by human beings replaced the need for translators and written word as we currently know it. Whether this is an inherent evil is certainly not clear. Hence, the wording of the item forces us to make an inappropriate value judgment." – **Stephen F. Steele,** professor, Institute for the Future, Anne Arundel Community College

The final word: A vision for how the "book" of the future will serve us.

"Instead of reading and writing, let's say communication and content creation will be easier and enhanced. I hope that the future of books is this: A regular size, regular weight hardcover will contain not paper but epaper that any book can be embedded into, and the content can change at my whim. I can move fluidly between professionally-produced audio and text with optional hyperlinks that bring me to definitions, criticism, reviews, and discussion forums - i.e. I can read to page 50, plug it into my car and listen to it for 10 pages, and pick up reading again on page 60 at my destination. Multimedia would be embedded - a novel might link to a character blog, a reference book might include video, author bios would be a video. The "paper" will be a full color touch screen…. My local library will loan me ebooks for free, that I can download without ever setting foot into a library building. Anyone would be able become a content creator, because of the ease of the publishing platform. And I would be able to seamlessly consume content in any format on any platform." – **Beth Gallaway,** library consultant and trainer

Part 3: A review of responses to a tension pair about how takeoff technologies will emerge in the future

The hot gadgets, applications, technology tools in 2020



Respondents were asked to explain their choice and "share your view of its implications for the future. What do you think will be the hot gadgets, applications, technology tools in 2020?" What follows is a selection of the hundreds of written elaborations and some of the recurring themes in those answers:

The experts' record is so lousy at spotting key technologies ahead of time that there is little chance they will see the killer gadgets and applications of 2020. If you had asked this question a decade ago, no one would have predicted the iPhone. If experts could already see them today, they really wouldn't be 'out of the blue' innovations.

"Our ability to predict hot gadgets has shown to be poor, and this isn't likely to change." – **Wojciech Dec,** Edge Engineering Group, Cisco Systems

“If they could be anticipated now, they'd be the hot gadgets *today*.” – **Charlie Martin,** author and consultant

“Trends and patterns that we will continue to see – swings between centralization and decentralization, openness and walled gardens, increasing growth of mobile and local information, search and aggregation – but we have no idea what the major gadgets and applications of 2020 will be. Most of the top websites of 10 years ago are no longer in the top 10 - and we never would have imagined many of the hot gadgets available today in 1999.” – **David Sifry**, CEO of Offbeat Guides, co-founder of Technorati

There are basic trends evident now and some groundwork that has been in place for years that will yield innovation. The internet of things is being built. Sensors will proliferate.

“More-powerful mobile devices, ever-cheaper netbooks, virtualization and cloud computing, reputation systems for social networking and group collaboration, sensors and other small systems reporting limited amounts of information, do-it-yourself embedded systems, robots, sophisticated algorithms for slurping up data and performing statistical analysis, visualization tools to report results of analysis, affective technologies, personalized and location-aware services, excellent facial and voice recognition, electronic paper, anomaly-based security monitoring, self-healing systems – that's a reasonable list to get started with. Beyond five years, everything is wide open.” – **Andy Oram**, editor and blogger, O’Reilly Media

“Ten years isn't very long, even in Internet years. The single biggest change over the last ten years, I think, has been the prevalence of mobile devices. I got my first iPod nine years ago, but had other digital music players long before that. I've been using RIMs since well before they'd filed the BlackBerry trademark, again more like fifteen years ago. “Cloud computing” has been talked about for more than ten years, and IPv6 is now fifteen years old as well, and neither of those have yet predominated, though I believe

they will in the next ten. In short, looking at today's popular technologies, I don't see many that weren't already thoroughly conceived of ten years ago." – **Bill Woodcock,** research director, Packet Clearing House, a nonprofit research organization

"The correct answer is a combination of the two. I think in the 'device' space we can see much of what will happen over the next few years: the ubiquitous availability of sensors and actuators, the cyber-car, various sorts of implants and proto-cyborg elements. But the application space is harder to predict." – **David Clark**, senior research scientist for the Next-Generation Internet, MIT professor

"The hot products of 2020, especially wearable, context-aware systems, already see their progenitors in current lab experiments. No major surprises for those who are already engaged in a good environmental scan." – **Alex Halavais**, vice president, Association of Internet Researchers

"There is nothing new under the sun, it is said, and much of what arrives by 2020, people will say "we did that at BBN in the 1970s" or "It was in Plato half a century ago." Was Facebook or Twitter evident ten years ago? Was it anticipated? I'd feel a little more confident with 2025 on this, but I expect a lot of surprises by 2020, and the beginnings of some massive movements based on a proliferation of networks of sensors and effectors." – **Jonathan Grudin,** principal researcher, Microsoft (stresses that these views are his own, not the company's)

"For me augmented reality has to be the future for 2020, together with it's close cousin the internet of things. I think that these two will grow up together over the coming years, and slowly creep more and more into our daily lives as more and more devices become web enabled, and the ability to connect to the web becomes ubiquitous. It will become commonplace to be able to overlay reviews of a product simply by pointing a screen at it, or check the weather forecast by pointing your phone at the sky." – **Rich Osborne,** Web Innovation Officer, University of Exeter

“I don't think totally new things will come out of nowhere but I do believe that even what we know today may be used differently or some new twist on existing technologies may take use by storm. We are creatures of habit and we are influenced tremendously by what those around us do. We don't like to admit that but it is true. No one really knows why things catch on but when they do, it is often a surprise. It is not really new but it can be a surprise.” – **Link Hoewing,** Vice President, Information Technology, Verizon Communications

One of the big reasons experts do not have a strong sense about the innovations of the future is that the environment of technology is still taking shape. Lots more bandwidth and computing power – for less cost than today – will spur changes that cannot be foreseen now.

“Some of 2020’s hot new gadgets are bound to come out of the blue. But for North Americans, I think the Next Big Thing will be an exponential jump in a well-known commodity: bandwidth. Residential bandwidth scarcity in both Canada and the US has held back the availability of immersive environments for personal messaging and multi-player online gaming, not to mention telemedicine, telecommuting, real hi-def entertainment and distance learning. Most of us are still stuck with a single-digit Mbit/s connection; highly asymmetric downlink/uplink architectures; high prices; and very few choices in service provider. If we can get, say, 30% of North American homes on a last mile of 50 megs down and 20 megs up by 2020, we’ll experience a sea-change in our online lives. This development will become especially important as more and more devices become networked, up to and including our kitchen appliances.” – **David Ellis,** York University, Toronto

“Most of the components are certainly around us, but what really distinguishes the way technology innovation is happening today is iterative and endless recombinations. The potential variety is so great, and the role of end users in shaping the outcome so strong, that there are a potentially limitless number of combinations. Technology innovation

will probably be a lot more bottom-up and organic as a result - forecasting it is less about understand linear processes and more about understanding non-linear processes and emergent behavior. It's going to be hard." – **Anthony Townsend,** research director, Institute for the Future

"We haven't even glimpsed what's possible yet - but my answer to this question is heavily conditioned on an uprising that will take real backbone and organization. The only way we'll get great new surprising gizmos and uses is if the network providers let it happen. I'm not confident that there are sufficient market pressures to make the access providers open up. We're getting good press releases but the reality is that they are oligopolists with a yearning for short-term control rather than long-term social benefit. So: yes, we will have amazing new tools in 2020, but only if we work purposefully towards the openness that will make that possible." – **Susan Crawford**, former member of President Obama's National Economic Council, now on the law faculty at the University of Michigan

Some trends are clear: Mobile connectivity and location-based services will grow in the next decade. Other hot items will include: bigger/thinner TVs, 3D displays, "consolidated," all-purpose gadgets and apps, speech recognition.

"It's incredibly difficult to predict which specific gadgets and applications will take off two years from now, let alone 10 years from now. It's far easier to predict in general terms, based on the direction that technology seems to be evolving: TVs will be bigger and thinner, they'll have higher-resolution displays, computing power will be cheaper and more ubiquitous, wireless data will achieve higher speeds, etc. But predicting specific hit devices – and the apps that they engender – is next to impossible. Who could have foreseen the iPhone, or its huge impact on the cellphone industry, even one year before it came out?" – **Dylan Tweney**, senior editor, Wired

"More than a forecast, we would like to state [that consumer needs will create special conditions for a certain kind of innovation]: consolidation instead of novelties. The path

of innovation in gadgets and online applications in the last years has been so incredibly fast that there seems to be a common cry useful adoption. Suppliers [will concentrate] on helping the user -- the customer -- in getting the best of innovation rather than in innovation per se. This will, indeed, decrease cutting edge technology in favour of major and mass adoption." – **Ismael Peña-Lopez**, lecturer at the Open University of Catalonia, School of Law and Political Science

"I predict thinner, sturdier, friendlier mobile platforms. I expect that input devices will go from "touch screen" to "touch–air" via interactive holographic sensors that sense movement in the air around you. Honda has truck sized thought controlled interfaces for its humanoid robot and other machinery at this moment. I suspect those will morph to "Borg-ish" hard wired wet and cyber-ware interfaces combined with tactile sensation/movement sensors and inputs that will be woven/ built into clothing that will extend your computing beyond screens and devices to your body as a total input device. Today's toy robot - will become your "Avatar" controlled through your handheld? Worn? Personal web access device - I don't think we can conceptualize what will come forth in the next 10 years. Just know it will be what we dream today." – **Cameron Lewis,** Program Manager, Arizona Department of Health Services

"Many of the components that will drive tomorrow's most innovative technologies are already being developed. The question is in how they will be used. Just as speech recognition, the semantic web and augmented reality will lead to "TeleLiving' - a natural conversation human-machine interaction, most of tomorrows applications will be based on today's technology." – **Bryan Trogdon,** President, First Semantic

"The only constant is change. In fact the pace of change continues to accelerate. Fundamentally, we can expect devices, mobility, location-based services, and sentiment to play a bigger role." – **R. "Ray" Wang**, Altimeter Group

"Today's 'savviest innovators' are in fact the ones that are inventing future hot gadgets

and applications. The 2020 themes to watch for will be intelligent devices and cloud services accessed across a wide variety of platforms: web, smartphone, tablet, set-top box, smart surface, etc. By 2020 we will see next generation 3D HD Display technology, coupled with multi-modal sensor input application integration. This will include HDTV with can recognize and understand the viewers using multi-modal (sight, sound, speech, touch) and services which help manage and personalize media. Imagine an experience more like Apple's Knowledge Navigator (circa 1988), where a conversational intelligent agent helps to organize and synthesize your work or entertainment or personal schedule, all completely integrated and personalized for you." – **William Luciw,** Managing Director, Viewpoint West Partners LLC

It's the unintended consequences that really surprise.

"At the pseudo-trivial, hand-waving, vague-generalization level - yes; many gadgets and applications will not be that surprising, especially when one includes the wild fantasies proposed in sci fi fiction. However, there are substantive examples of what exists now, that wasn't even fantasized 10-20 years ago. I expect we will see many innovations that almost everyone will find 'came out of the blue' - notably including many unexpected, unintended results from innovation that was initiated for some entirely-different purpose. (E.g., it might be said that the foremost - and completely unintended and unpredicted - result of the invention of automobiles was the creation of suburbs with most people residing far-distant from where they work.)" – **Jim Warren,** longtime tech entrepreneur and activist

"Indwelling" technology is the kind with the greatest impact.

"The hottest gadgets in 2020 will certainly involve extending one's senses and one's body. In fact, this has been the case for all inventions since humans first made stone tools, and painted the walls of caves. That's because humans are characterized not only by their intelligence and their ability to speak, but by their capacity to extend their senses, and their abilities, through their tools and technologies. Michael Polanyi, a

scientist and philosopher, called this *indwelling*. It is through *indwelling* that the carpenter's tool becomes an extension of his arm, and he has the power to pound nails through wood…. The computers and smart phones of today are to some degree extensions of ourselves, but not to the extent that a hammer extends a carpenter, a car enlarges a driver or a plane enlarges a pilot. Something other than a computer or a smart phone will do that. Hopefully this will happen by 2020. If not, it will eventually." – **Doc Searls**, co-author of "The Cluetrain Manifesto"

It takes a generation to figure out which technologies have real impact and which are just fads.

"Peter Drucker wrote about the major transformations in history. The printing press, steam engine driven industrial revolution, and the then emerging Internet. His main point, that I share, is that it takes a generation, about 25 years, for the new 'thing' to real have its impact. At first society uses the new tool to better do what they have been doing. The generation raised with it finds totally new things and ways to do things. Thus we will be working in jobs that we cannot now see or define. Going through our work and play days doing things we cannot now envision or perhaps which only a few now envision, but have trouble getting others to see their vision." – **Ed Lyell**, former member of the Colorado State Board of Education and Telecommunication Advisory Commission

Personal data clouds will emerge.

"I choose to see personal web-server technology (Opera Unite, Firefox POW, etc) as a breakthrough technology, so people can put their own data into the cloud without paying Flickr or whomever. It is this sort of 'personal technology' I believe will characterize (what we now call) web 3.0 (and not 3D, or semantic web, etc.). So my dilemma is that, while these technologies are pretty evident today, it is not clear that the people I suspect Pew counts as "the savviest innovators" are looking at them. So I pick

"out of the blue" even though (I think) I can see them coming from a mile away." – **Stephen Downes,** National Research Council, Canada

Brain interfaces might be on the horizon.

"I'll take a gamble: In 2020 (or perhaps a couple years later) heads-up-displays with brain-control interfaces will start to emerge as a useful way to interact with information. Kids, businesspeople and academics will want them. People will be worried that everyone is 'tuning out', but others will say that this is an inevitable and obvious progression of technology." – **Bernie Hogan,** Oxford Internet Institute

Look to emerging markets for "out of the blue" changes.

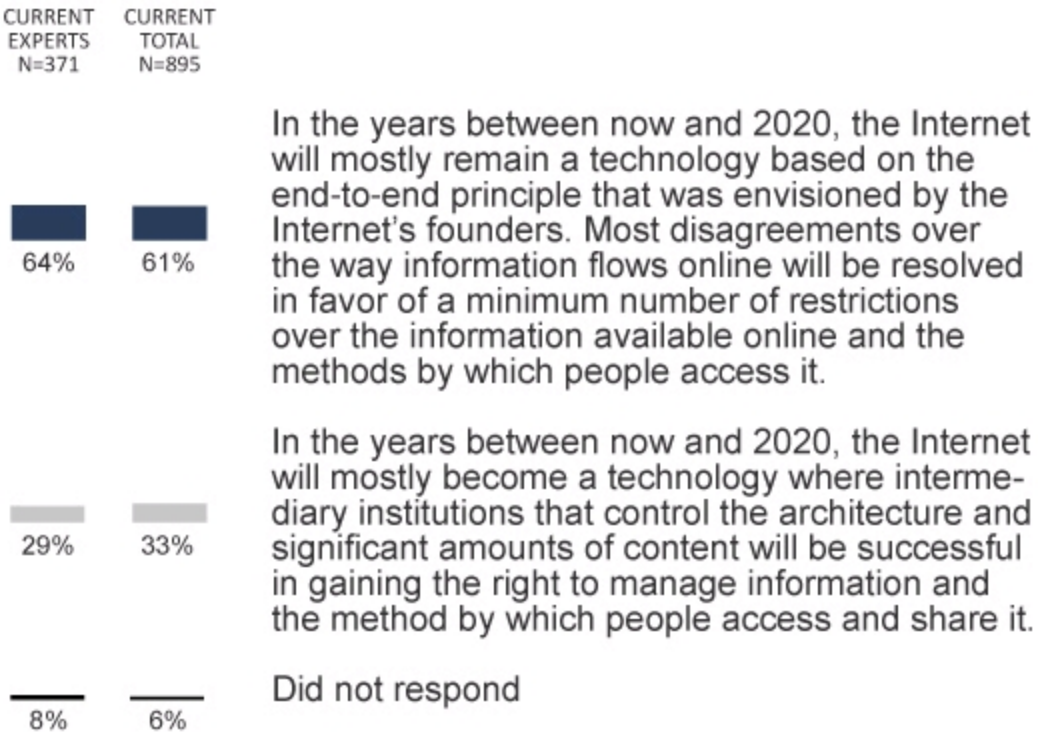
"Depends on what one means by 'out of the blue' - I think a lot of the hot gadgets and apps will come from the developing world and non-Western markets. Thus to Americans and Europeans they may seem more 'out of the blue' than to others." – **Rebecca MacKinnon**, Princeton Center for Information Technology Policy

The health care arena will be a hot growth area.

"Health care will see new applications -- driven in part by financial necessity and in part by expanded possibilities. Individuals will play a larger role in their own health care. We will monitor and treat ourselves and electronic communication with medical professionals will be common. These applications will be driven by custom and law as well as new technology and knowledge. They may be invented in developing nations with very different needs and customs from the US. Improved biological technology and knowledge will also drive unexpected applications of the Internet." – **Larry Press,** California State University, Dominguz Hills

Part 4: A review of responses to a tension pair about the evolution of the architecture and structure of the Internet: Will the Internet still be dominated by the end-to-end principle?

The structure of the Internet



Respondents were asked to explain their choice and "note organizations you expect to be most likely to influence the future of the Internet and share your view of the effects of this between now and 2020."

A number of respondents pointed out that some of the key issues related to the functioning of the internet and its architecture were laid out by Jonathan Zittrain in his "The Future of the Internet—And How to Stop it."[2] Several said their views matched Zittrain's: that the internet's basic open character and its ability to foster innovation are

threatened by "tethered" appliances and applications that are controlled by vendors.

What follows is a selection of the hundreds of written elaborations and some of the recurring themes in those answers:

There is too much good history and good experience with the end-to-end internet to see it largely overturned. Openness has its own virtues and those who resist it will fall behind those who enable it. Users will rise up if there are too many restrictions that get in the way of the information they want and the content they want to create.

"The Net users will band together to keep the Net open. They will continue to choose open over closed and gated." – **Jerry Berman**, chair, Center for Democracy and Technology

"There is too much at stake to allow intermediaries to control the pipe." – **Peng Hwa Ang**, director, Singapore Internet Research Center

"Incumbent network operators in some nations will succeed in asserting increased control over applications, but, in the long run, they will be at a disadvantage. This will vary from nation to nation, and those which view the Internet as basic infrastructure and act to balance public interest and quality of life along with the return on investment of network operators will be at an advantage in the future. This is related to the issue of ownership. The question is not whether we will have ubiquitous high-speed networks in the future, the question is who will own and control them -- private corporations, government, users? Ownership/control will be disbursed among a mix of organizations each at different network levels." – **Larry Press,** California State University, Dominguz Hills

"There are large numbers of people working to protect the end-to-end principle within the confines of organized structures (ICANN) and outside of formal venues (alternate

roots)." – **Elaine Pruis**, VP for client services of Minds + Machines and ICANN participant

"It seems to me inevitable that nation states will attempt to exert more control over the Internet. However, I think that these will be relatively small changes, so that the internet will remain relatively free." – **Hal Varian,** Google, chief economist

"This will be an ongoing debate, particularly when traditional organizations see the Internet encroaching on their legitimacy and relevance in the Internet Age. These groups will flail around to protect their business models and perceived relevance, but there will be equally powerful capabilities emerging from the Internet community that will break through/counter those new controls/restrictions on the flows of information." -- **Richard Forno,** Software Engineering Institute, Carnegie Mellon University

Those who took the opposite view were not necessarily happy about it, but they argued there are too many powerful forces pushing towards more control of the internet for the end-to-end principle to survive. Governments and businesses have all kinds of reasons to control what happens online.

"Given events in China and Iran, I am going to take a rare (for me) pessimistic position. The forces of central control, politically and economically, are moving to recentralize the power they lost when the Internet grew explosively. The net neutrality debate in the USA seems to temporarily have restrained the cable and telcos from exerting centralized control over the architecture, but who knows what will happen politically with future administrations? Unless a sufficient number of people resist, I see more and more control and intermediation being forced upon us." – **Howard Rheingold,** author of several prominent books on technology, teacher at Stanford University and University of California-Berkeley

"I hope for the egalitarian selection I've made. I fear that the greed of the fewer and

fewer, more and more powerful conglomerates, cartels, multi-nationals and monopolies, will allow them to use their power over government to choke the power of end-users to access and share the powerful benefits of different-time, different-place, near-'instantaneous', egalitarian/equalitarian communications." – **Jim Warren,** longtime tech entrepreneur and activist

"Much as I want the end-to-end principle to remain I see it dying. Most users today, and most vendors of network services, perceive the net as a system of applications not as a system that transports packets. I believe that the internet is headed towards being a 'lumpy' network more like the several mobile phone networks in the U.S. than the uniform internet of today. There are a lot of pressures to drive this lumpiness - We've got the desire of vendors to lock in customers, we have national competitions and firewalls, we have resource scarcity (such as IPv4 addresses that are driving the net to partition via network address translation, NAT, devices) [PS, I believe that IPv6 may prove a dud], reaction to excessively heavy regulatory systems such as ICANN, etc." **-- Karl Auerbach,** Chief Technology Officer, InterWorking Labs, Inc

"The locked-down future is more realistic as things stand now. We've got a very cautious government, an international movement towards greater control, and a pliant public. I wish this wasn't the case." – **Susan Crawford**, former member of President Obama's National Economic Council, now on the law faculty at the University of Michigan

"As the internet becomes ubiquitous and increasingly important in commerce and politics, it will become increasingly important and profitable to control it. Control will be exerted through control of systems and architectures, networks, points of access, platforms for sharing, and content. 'Dedemocratization' processes are currently in the ascendancy in the US and other nations and these political trends are conducive to increased control by governments and corporations over all aspects of the internet. As in politics, the democratization (and dedemocratization) of the internet is not linear. But the trend over the next decade will be dedemocratization. We already see this in the attempts by China and Iran to control access and content and in the so-called

Homeland Security legislation in the US to monitor internet activity." – **Benjamin Mordecai Ben-Baruch,** market researcher and consultant to non-profits

There will be alternative networks for companies and individuals that prefer to have a more controlled environment for sharing and consuming content.

"A number of companies have built global IP networks that are not the Public Internet, but provide similar capabilities to companies that don't want their traffic to mix with the Internet. These IP networks often offer QOS services, MPLS VPNs, MPLS pseudowire private circuits, VoIP services, telepresence services and so on. Soon they will offer secure cloud computing services as well, competing with Amazon and Google but not on the Public Internet. This activity will secure the Internet's end-to-end principle on the Public Internet, because anyone who has a technical or business reason to want something different, can get their needs met on the private internets. This reduces the pressure on the Internet and the end-to-end principle remains secure. In fact, IPv6 means that you will see even more end-to-end capabilities on the Internet of 2020." – **Michael Dillon**, network consultant for BT

Regional differences will become more pronounced.

"I think on the whole the way the internet works will be mirrored by the country in which it is accessed. Although it may well be possible to access anything from anywhere online, in reality the physical requirements such as routers and access points will always mean that locality plays some role in what is and is not possible. We will start to see more regionality of control, and greater development of specific language based 'sub-webs' as the predominantly western centric web becomes less important to the Asian and African continents, and they develop their own dominant sites along with their own culturally driven methods of control and administration. However the vast nature of the web will still ensure that the majority of web content remains freely available, following the end-to-end principle." -- **Rich Osborne,** Web Innovation Officer, University of

Exeter

The future will produce a hybrid environment with a bit more control exercised in the core of the internet for some purposes, but for other purposes will enable end-to-end practices. Some things will have to be managed, especially if the capacity of the current internet becomes strained.

"While obviously these are contentious issues, in some ways this is a false dichotomy. Intermediary institutions may well gain more control. However, there will be minimal restrictions on information availability, because that's what consumers will demand." – **Tom Lenard,** President, Technology Policy Institute

"I think we will have an outcome that is a hybrid of your two options. For many users, the end-to-end principle in its literal form is a pain--it means they have to install software and manage upgrades on a PC that is complex and insecure. Much better to take advantages of services that are professionally run. But I think the end-users will be able to maintain the ability to reach the content of their choice and use the applications of their choice. I think the crucial question is not where a function is located (at the end-point or from a service provider somewhere on the network), but the extent to which the end-user will preserve the right to choose providers that they decide to trust. The real question is about trust, not location." – **David Clark**, senior research scientist for the Next-Generation Internet, MIT professor

"I believe that we go through cycles of expansion and contraction in our freedoms in different environments, or spheres of activity. The new and often unmanageable is tamed, and brought under control. Perhaps that is a good thing, as that state helps to stimulate the next new thing. So, if I wasn't clear, the internet will become far more controlled, managed, segmented than it is today." – **Oscar Gandy,** emeritus professor, University of Pennsylvania

"This is a very hard one. It's complex and multidimensional. Big things like 'net

neutrality' as well as smaller things like customized brokerage and management. So it's not a zero-sum game. Both will increase. Fights to maintain net neutrality will be fierce, but specialized and proprietary systems will also flourish." – **Ron Rice,** University of California, Santa Barbara

"I really want to check and believe the first option, but it seems that the rapid increase in use of the internet is not being matched with development and expansion of the infrastructure- e.g. the predictions that studies suggest we may run out of internet capacity in a few years. So, supply may not keep up with demand and that suggests a bleaker future for an open end to end internet." – **Alan Levine,** Chief Technology Officer, New Media Consortium

"I'm split on this question as well. I think we'll see something in the middle. Understanding that information is static and that communication is information in action; communication is the key and access is the lock. Banking/financial institutions and merchant organizations will develop authenticating/verifying roles of business that will enhance commerce. Governments will develop roles of engaging in the communities to govern institutions and protect the constituents. Access will be open and unrestricted but transactions will be governed by rules of commerce and community." – **Jack Holt,** senior strategist for emerging media, U.S. Department of Defense

The dictates of business will shape large parts of the online experience and more pay-to-play business models will affect information flows online.

"'If the entertainment industry gains control of the routers, it will stop being the internet, so your dystopian scenario could happen, but not as written." -- **Clay Shirky,** professor, Interactive Telecommunications Program, New York University

"I think a larger portion of the web will become fee based by 2020 and the information will be managed. Even web start-ups will be looking for viable business models, the

monetary issues of Facebook & Twitter will not be repeated." – **Brad Adgate,** Senior Vice President, Research, Horizon Research

"My view is that rights owners are well organised and have the sympathy of governments. (This view is reinforced by events such as the French government's recent decision that Google Books contravenes French copyright law, and that French law overrides foreign law on the Internet in respect of services available in France). The answer probably lies between the two : the internet will ideally by based on the end-to-end principle, but there will be a growing realisation - based in a combination of education and legislation - that there are rights in information that necessarily place some restrictions on its use and re-use. The eventual balance will be dictated by a combination of circumstances, and possibly by alliances of odd bedfellows such as interventionist governments and the music industries." – **Peter Griffiths,** former Head of Information at the Home Office within the Office of the Chief Information Officer, United Kingdom

"There will continue to be centralizing of the content and the resources. It is the way of business to grow and capture your competition. This the area where I have the greatest concern, in that it will become too centralized. Go into many small towns today and you will see a Walmart and many empty locally owned shops, while not inherently bad for the small town, it is a sign of the centralization and more power in the marketplace. In some ways the internet will continue to grow and be able to accommodate both the large and the small players, if a few specific areas are guaranteed open access. But there is a point at which the audience will stop growing and the centralization will take root. We are just at the cusp another growth spurt, so that will take longer than 10 years." – **Michael Nelson,** Georgetown University, Communication, Culture and Technology program

The needs of users themselves will sometimes drive changes that bring more control of online material and less end-to-end activity.

"I think there will be a slight difference in the world as I see but I agree generally that the openness of the Internet will remain in place. What will change is that people will want to access customized solutions, use special purpose devices like the Kindle, and will have a need for better connections for various things like telemedicine. All of this will not be in sync with the end-to-end principle but it will use the Internet architecture and provide value." – **Link Hoewing,** Vice President, Information Technology, Verizon Communications

There will be "content service providers" who are gatekeepers of many users' online experiences.

"The notion of an 'Internet Service Provider' will still exist by 2020, but the main distinction will be the service packaging of base and premium services, both core and related. Perhaps a more descriptive term might be 'Communications Service Provider' (CSP). For example, your CSP could provide you with broadband access, and in addition offer VOIP services. In addition, the CSP could offer IPTV or so-called 'over-the-top' services such as Video-On-Demand, for additional fees, on certain devices. Another service the CSP could offer might be mobile broadband. In the process of delivering these various communication services, the CSP must invest huge amounts of capital in telecommunication infrastructure before any revenue can be realized. These CSPs then act in their own corporate interests in order to maximize the profitability of the services offered. However, these CSPs effectively become gatekeepers for the 'last mile' of internet connectivity needed to deliver consumer services. This means that pricing and service offerings, availability, etc. are all under the control of the CSP. A recent example is Comcast purchasing NBC Universal. Now it would be at least theoretically possible for NBC content to receive special treatment on Comcast networks." -- **William Luciw,** Managing Director, Viewpoint West Partners LLC

This particularly long and thoughtful answer from **Doc Searls,** co-author of the

"Cluetrain Manifesto," is reported in full. It does not fall on one side of the tension pair or the other. It addresses different ways of thinking about the internet's architecture, especially in the future:

"There will always be a struggle to reconcile the Net's end-to-end principle with the need for companies and technologies operating between those ends to innovate and make money. This tension will produce more progress than either the principle by itself or the narrow interests of network operators and other entities working between the Net's countless ends.

"Today these interests are seen as opposed — mostly because incumbent network operators want to protect businesses they see threatened by the Net's end-to-end nature, which cares not a bit about who makes money or how. But in the future they will be seen as symbiotic, because both the principle and networks operating within it will be seen as essential infrastructure. So will what each of does to the help raise and renovate the Net's vast barn.

"The term *infrastructure* has traditionally been applied mostly to the public variety: roads, bridges, electrical systems, water systems, waste treatment and so on. But this tradition only goes back to the Seventies. Look up *infrastructure* in a dictionary from the 1960s or earlier and you won't find it (except in the OED). Today are still no institutes or academic departments devoted to infrastructure. It's a subject in many fields, yet not a field in itself.

"But we do generally understand what infrastructure is. It's something solid and common we can build on. It's geology humans make for themselves.

"Digital technology, and the Internet in particular, provide an interesting challenge for understanding infrastructure, because we rely on it, yet it is not solid in any physical sense. It is *like* physical structures, but not itself physical. We go *on* the Net, as if it were

a road or a plane. We build on it too. Yet it is not a thing.

"Inspired by Craig Burton's description of the Net as a hollow sphere — a three-dimensional zero comprised entirely of ends — David Weinberger and I wrote *World of Ends* in 2003 (http://worldofends.com). The purpose was to make the Net more understandable, especially to companies (such as phone and cable carriers) that had been misunderstanding it. Lots of people agreed with us, but none of those people ran the kinds of companies we addressed.

"But, to be fair, most people still don't understand the Net. Look up "The Internet is" on Google (with the quotes). After you get past the top entry (Wikipedia's), here's what they say:

1. a Series of Tubes
2. terrible
3. really big
4. for porn
5. shit
6. good
7. wrong
8. killing storytelling
9. dead
10. serious business
11. for everyone
12. underrated
13. infected

14 about to die

15 broken

16 Christmas all the time

17 altering our brains

18 changing health care

19 laughing at NBC

20 changing the way we watch TV

21 changing the scientific method

22 dead and boring

23 not shit

24 made of kittens

25 alive and well

26 blessed

27 almost full

28 distracting

29 a brain

30 cloudy

"Do the same on Twitter, and you'll get results just as confusing. At this moment (your search will vary; this is the Live Web here), the top results are:

1. a weird, WEIRD place
2. full of feel good lectures
3. the Best Place to get best notebook computer deals

4. Made of Cats
5. Down
6. For porn
7. one of the best and worst things at the same time
8. so small
9. going slow
10. not my friend at the moment
11. blocked
12. letting me down
13. going off at 12
14. not working
15. magic
16. still debatable
17. like a jungle
18. eleven years old
19. worsening by the day
20. extremely variable
21. full of odd but exciting people
22. becoming the Googlenet
23. fixed
24. forever
25. a battlefield
26. a great network for helping others around the world

27 more than a global pornography network

28 slow

29 making you go nuts

30 so much faster bc im like the only 1 on it

"(I took out the duplicates. There were many involving cats and porn.)

"Part of the problem is that we understand the Net in very different and conflicting ways. For example, when we say the Net consists of "sites," with "domains" and "locations" that we "architect," "design," "build" and "visit," we are saying the Internet is *a place*. It's real estate. But if we say the Net is a "medium" for the "distribution" of "content" to "consumers" who "download" it, we're saying the Net is *a shipping system*.

"These metaphors are very different. They yield different approaches to business and lawmaking, to name just two areas of conflict.

"Bob Frankston, co-inventor (with Dan Bricklin) of spreadsheet software (Visicalc) and one of the fathers of home networking, says the end-state of the Net's current development is *ambient connectivity*, which "gives us access to the oceans of copper, fiber and radios that surround us." Within those are what Frankston calls a "sea of bits" to which all of us contribute. To help clarify the anti-scarce nature of bits, he explains, "Bits aren't really like kernels of corn. They are more like words. You may run out of red paint but you don't run out of the color red."

"Much has been written about the "economics of abundance," but we have barely begun to understand what that means or what can be done with it. The threats are much easier to perceive than the opportunities. Google is one notable exception to that. Asked at a Harvard meeting to explain the company's strategy of moving into businesses where it expects to make no money directly for the services it offers, a Google executive

explained that the company looked for "second and third order effects."

"JP Rangaswami, Chief Scientist for BT (disclosure: I consult BT) describes these as "because effects." You make money *because of* something rather than *with* it. Google makes money *because of* search, and *because of* Gmail. Not *with* them. Not directly.

"Yet money can still be made *with* goods and services — even totally commodified ones. Amazon makes money with back-end Web services such as EC2 (computing) and S3 (data storage). Phone, cable and other carriers can make money with "dumb pipes" too. They are also in perfect positions to offer low-latency services directly to their many customers at homes and in businesses. All the carriers need to do is realize that there are benefits to incumbency other than charging monopoly rents.

"The biggest danger for the Net and its use comes not from carriers, but from copyright absolutists in what we have recently come to call the "content" industry. For example, in the U.S. the DMCA (Digital Millenium Copyright Act), passed in 1998, was built to protect the interests of copyright holders and served as a model for similar lawmaking in other countries. What it did was little to protect the industries that lobbied its passing, while at the same time hurting or preventing a variety of other industries. Most notable (at least for me) was the embryonic Internet radio industry, which was just starting to take off when the DMCA came along. The saga that followed is woefully complex, and the story is far from over, but the result in the meantime is a still-infant industry that suffers many more restrictions in respect to "content" than over-the-air radio stations. Usage fees for music are much higher than those faced by broadcasters — so high that making serious money by webcasting music is nearly impossible.

"There are also tight restrictions on what music can be played, when, and how often. Music on podcasts is also essentially prohibited, because podcasters need to "clear rights" for every piece of copyrighted music they play. That's why, except for "podsafe" music, podcasting today is almost all talk.

“I’ll give the last words here to Cory Doctorow, who publishes them freely in his new book *Content*:

... there is an information economy. You don't even need a computer to participate. My barber, an avowed technophobe who rebuilds antique motorcycles and doesn't own a PC, benefited from the information economy when I found him by googling for barbershops in my neighborhood.

Teachers benefit from the information economy when they share lesson plans with their colleagues around the world by email. Doctors benefit from the information economy when they move their patient files to efficient digital formats. Insurance companies benefit from the information economy through better access to fresh data used in the preparation of actuarial tables. Marinas benefit from the information economy when office-slaves look up the weekend's weather online and decide to skip out on Friday for a weekend's sailing. Families of migrant workers benefit from the information economy when their sons and daughters wire cash home from a convenience store Western Union terminal.

This stuff generates wealth for those who practice it. It enriches the country and improves our lives.

And it can peacefully co-exist with movies, music and microcode, but not if Hollywood gets to call the shots. Where IT managers are expected to police their networks and systems for unauthorized copying — no matter what that does to productivity — they cannot co-exist. Where our operating systems are rendered inoperable by “copy protection,” they cannot co-exist. Where our educational institutions are turned into conscript enforcers for the record industry, they cannot co-exist.

“The information economy is all around us. The countries that embrace it will emerge as global economic superpowers. The countries that stubbornly hold to the simplistic idea

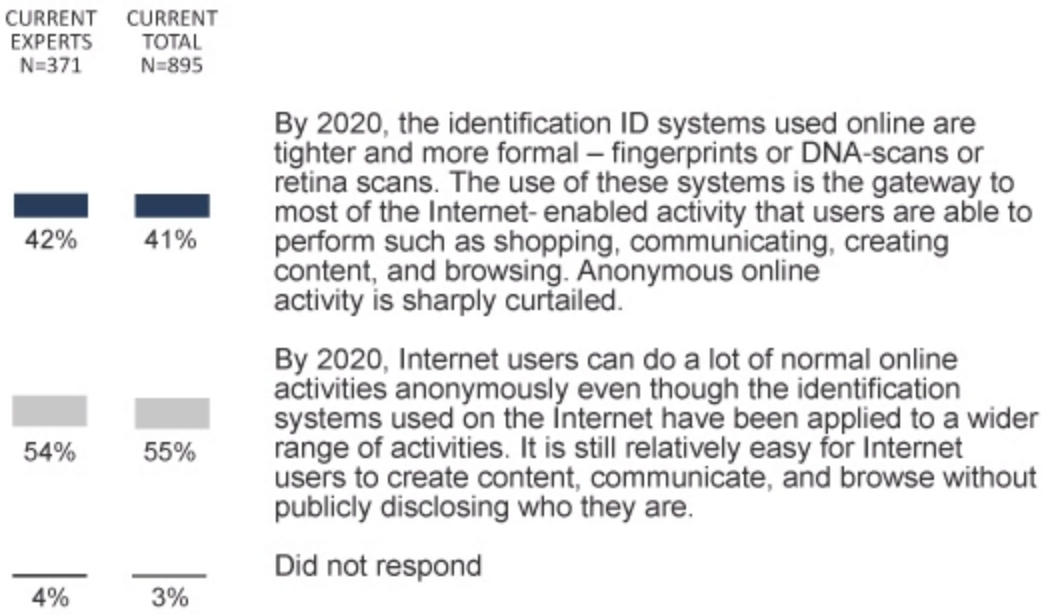
that the information economy is about selling information will end up at the bottom of the pile."

NOTES

[2] Zittrain, Jonathan. *The Future of the Internet-And How to Stop It.* Caravan Books. 2008. Note: Zittrain is on the advisory board of the Pew Research Center's Internet & American Life Project.

Part 5: A review of responses to a tension pair about the future of anonymity online

The future of anonymous activity online



Respondents were asked to explain their choice and "share your view about the future of anonymous activity online by the year 2020." What follows is a selection of the hundreds of written elaborations and some of the recurring themes in those answers:

The pressures for authentication of internet users are growing and many are legitimate. New methods to accomplish that are being explored but it is not yet clear which ones will prevail in the marketplace.

"The privacy and civil liberties battles over the next decade will increasingly focus on the growing demands for identity credentials. New systems for authentication will bring new problems as more identity information will create new opportunities for criminals. Identity management companies will also go bankrupt and try to sell off their primary asset -- the biometric identifiers of their customers." – **Marc Rotenberg**, executive

director, Electronic Privacy Information Center

“We're moving into an increasingly authenticated and permission-based world. We'll be known to others as a condition of doing what we want to do. That may not be all bad news - we'll get loyalty points, after all - but we'll have to ensure that traditionally anonymous political speech and criticism is somehow protected. When it comes to commerce, anonymity is over.” -- **Susan Crawford**, former member of President Obama’s National Economic Council, now on the law faculty at the University of Michigan

“Anonymity online will gradually become a lot like anonymity in the real world. When we encounter it, we'll take a firm grip on our wallet and leave the neighborhood as soon as possible -- unless we're doing something we're ashamed of.” – **Stewart Baker,** internet legal specialist at the law firm Steptoe & Johnson

“The routine and pervasive corporate and governmental surveillance, tracking and ‘proviling’ (profiling) systems that are already much too widespread are certain to continue and expand. Those who are in positions of power - both corporate and governmental - ALWAYS want to know ever-more about everyone. Additionally, the minority of wrong-doers and ‘net-abusers’ will continue to fuel the reasons - and lame excuses - for government to pursue evermore surveillance, and be more and more demanding in prohibiting anonymous activities. (Except of course, for protecting the privacy of their own members and powerful friends. ;-)” -- **Jim Warren,** longtime tech entrepreneur and activist

“Given the amount of communications monitoring governments already do, we're likely already past this point. There will still be ways for determined individuals and groups to hide online, but only in their own corners. The decade and a half-long territorialization of the internet by governments will continue unabated, and probably accelerate.” -- **Anthony Townsend,** research director, Institute for the Future

“I fully expect the pressures from both business and governance sectors to result in the widespread adoption of more reliable authentication for digitally enabled transactions. I don't limit ‘pressures’ to threats and demands, as there will also be benefits associated with reliable identification. Anonymity will increasingly be associated with ‘antisocial’ behavior, and it will be moved to the boundaries or fringes of the net.” -- **Oscar Gandy,** emeritus professor, University of Pennsylvania

“We expect opposite trends in matters of identification and anonymity on the Net. On the one hand, as e-commerce, e-administration, e-democracy or e-learning grow (and we definitely think they will), robust and fool-proof identification systems will become more and more usual and even normal in everyday life. We will grow used to real identification in many places and will be happy to, as the user experience will benefit from it: more personalization in services, less hazard of being the victim of cybercrime, more efficiency in online transactions, etc. The rise of the e-portfolio (academic or professional, personal or institutional) will have its multiplier effect in requiring more formal and frequent online identification. On the other hand, better search engines (absolutely pervasive in their web scanning), augmented reality and the blurring of online and offline life, and more surveillance by governments and criminal organizations (and especially when both collude in corrupt or non-democratic regimes) will demand an increased need for anonymity just for the sake of personal security.” -- **Ismael Peña-Lopez**, lecturer at the Open University of Catalonia, School of Law and Political Science

“The question confounds “authentication” with “identification”. There are few market forces that would increase formal authentication of user identity. But even though Internet users may retain the perception that they are anonymous (and other users may not know who they are) advertising-funded service providers have enormous motivation to identify users, and are rapidly instituting monitoring capabilities everywhere.” – **Larry Masinter,** Principal Scientist and standards advocate, Adobe Systems

"Poor security--whether we are talking about hacking a credit card company for use data or unauthorized access to real-time drone images in Afghanistan—is already a major problem, and as I see it, the only real solutions will be biometrics in some form. Fingerprint, DNA and/or retinal scanners could protect consumers and industry, and they would seem to be a must for countries engaged in technological warfare." – **Jack Hicks,** professor, University of California-Irvine

The law and new regulations will give people some privacy protections even though they are required to disclose more. There will be a reasonable logic to sorting out what can be done anonymously and what requires authentication online. "Pseudonymity" will be available to people. Confidentiality and autonomy will be preserved and strengthened by then.

"Even the Wild West was tamed with laws, schools, and societal norms. So too the web." – **Tom Wolzien,** longtime telecommunications analyst, Chairman, Wolzien LLC

"'It will be an archipelago of named users, who get a lot of value from participating in that part of the ecosystem, but still set in an ocean of anonymity." -- **Clay Shirky,** professor, Interactive Telecommunications Program, New York University

"Electronic identification systems will be more routinely built in to online programs and services. Relevant policies and regulations will be developed to help preserve user privacy when needed. These identification systems will make it easier for users to make secure purchases, access information and services, archive data, and participate in proprietary online systems. It will also make it easier to monitor and protect users from electronic predators and rip-off artists who like to operate in the dark. Unfortunately, there will also likely be some loss of privacy with the growth of these built-in electronic identification systems, but I believe the potential benefits of these systems will outweigh the detriments." – **Gary Kreps,** Chair of Department of Communications, George Mason University

“Authentication systems will be more prevalent to overcome security problems for activities that require identification. For many purposes, however, there will be no need to identify people and companies will have no interest in knowing individuals' identities.” -- **Tom Lenard,** President, Technology Policy Institute

“We still lack means by which an individual can selectively and gracefully shift from fully to partially anonymous, and from unidentified to identified — yet in ways that can be controlled and minimized (or maximized) as much as the individual (and others with which he or she interacts) permit. In fact, we’re a long way off. The main reason is that most of the “identity systems” we know put control on the side of sellers, governments, and other institutions, and not with the individual. In time systems that give users control will be developed. These will be native to users and not provided only by large organizations (such as Microsoft, Google or the government).” -- **Doc Searls**, co-author of “The Cluetrain Manifesto”

“I think the choice is less one between anonymity and eponymity, but between anonymity and pseudonymity. I can't see the pipe dreams of law enforcement agencies - taken to the extreme, biometrics in every device - come true any more than I can see users accept the intrusive copyright protection mechanisms which the music and movie industries would like to implement. Other than for law enforcement hardliners, the challenge is not to tie every online activity to a specific identified user, but simply to verify that the activity is carried out by (or at least on behalf of) an actual human being rather than by a spambot or other malicious and disruptive entity - and for this, verified pseudonymity is sufficient. This is where OpenID and similar verification systems come in, of course - and I think we'll see increasing standardisation here. To require eponymity for all Internet activity ends up squeezing the life out of the Net, to allow unverified anonymity allows it to be overwhelmed with spam and identity theft - the only workable middle way is reliable, verifiable pseudonymity.” -- **Axel Bruns,** Associate Professor, Queensland University of Technology

“The key here is ‘publicly disclosing’ -- that is, folks can maintain anonymity in the basic sense, but there will be more technical ways to identify the user, even by associations and patterns as well as IP. That is, folks will continue to be able to choose to post things anonymously -- more accurately, via pseudonym, where they have an ongoing identity, but not their identifiable real self -- but there will also be more systems requiring identification.” **Ron Rice,** University of California, Santa Barbara

“Again I don't totally agree with this point. Anonymity is important and will remain so for public involvement and participation. We will find ways to keep this balance between the need for anonymity in public settings and identifying ourselves in settings where it is critical to know who you are dealing with. Ironically, users themselves may well demand more and more that people identify who they are and authenticate. They often feel their privacy is threatened by people they don't know who somehow ‘know them.” -- **Link Hoewing,** Vice President, Information Technology, Verizon Communications

“There is a difference between anonymity to the state and anonymity to others. Not all information systems will be completely open and interoperable. Thus, people will still be able to post in one forum without it necessarily leaking to all forums, common on one blog without it leaking to other blogs. The state may be able to track the IPs of individuals on the network, but the average person will not be able to completely stalk or track another person. I think that confidentiality on the Internet is far more significant than anonymity. Who has -access- to what data is a far more important concern to me than whether data can be tied to an individual. For example, banking will never be anonymous, but it should stay confidential.” -- **Bernie Hogan,** Oxford Internet Institute

“Anonymity will continue to have its place; that is the architecture of the web and it will be difficult to change that. Nonetheless, I believe that verified identity will come to be seen as an added value in transactions (including conversations) and as a way to recognize more value (reward in financial or ego terms).” -- **Jeff Jarvis,** prominent blogger, professor, City University of New York Graduate School of Journalism

"The 3D mobile media cloud will be a safe cloud, not the bizarre unsafe mess that today's computing and emailing is. Anonymity as such will be reduced, and we will have something new as well: partial anonymity, using partial identities. This means: I stay anonymous, but I hand out a trusted and checked piece of information, stating e.g. that I am a male, or that I am under 18, or both." -- **Marcel Bullinga**, Dutch Futurist at futurecheck.com

"We'll see a wide range of online identity options, from anonymity, to different levels of reasonably verified identity. Whistleblowers, for example, need anonymity. Public discussion boards need some modest level of verified identity, whereas home banking needs strong authentication." -- **Craig Newmark,** founder Craig's List

With some extra work, though, users will still be able to move around online without being known. There are still good reasons for people to want to be anonymous online.

"Identity and attribution will be important in many specific contexts, and non-anonymous enclaves may emerge to support that. Domains that do support anonymity, and anonymous modes, with perhaps limited functionality, will exist. Continuous exhortation to have such capability or related innovation may be the keys." **Marjory S. Blumenthal**, former director, Computer Science and Telecommunications Board

"The form of this question assumes that today, users can act without revealing their identity. This is an illusion. One has to work quite hard today to be truly anonymous. I think that ability will persist, but we will come to understand that the default expectation should be that folks know who we are." – **David Clark**, senior research scientist for the Next-Generation Internet, MIT professor

"Online anonymity is under threat and is unlikely to remain substantially the same in

the next decade. While there are excellent, compelling reasons to ensure that anonymous speech is possible on the internet, there's a concerted effort to eliminate anonymity to address concerns about criminal behavior, fraud, spam and terrorism. Because there's not an organized anonymity lobby, I fear this is a battle the anonymous will lose." – **Ethan Zuckerman**, Global Voices

There are still sufficient "workarounds" that will allow people some measure of anonymity. The "semantic web" will help.

"The two alternatives really don't work. Anonymity from the government or people with power will be hard. 'Public' anonymity will be easy, with screen names." -- **Esther Dyson**, longtime Internet expert and investor

"Emerging Semantic Web technologies may actually IMPROVE privacy by making it easier for people to control and protect sensitive personal information. Right now, your choice is simple: if you don't want strangers to see pictures of your kids, don't put them on Flickr. But imagine a more intelligent system that lets you control who sees what, depending on who they are, what their relationship is to you, and what it is they want to see. So, only your friends or family members can see those pictures. More to the point, a more intelligent Semantic Web will understand the sensitive nature of that information and work to protect it." – **Chris Marriott,** Vice President, interactive marketing services, Acxiom Corporation

The rise of social media and all the personal disclosures that go along with online contributions are as much a challenge to anonymity as particular authentication requirements. New online amateur forensics trackers can hunt down people with relative ease. There will also be reasons people will want to disclose information about themselves in order to manage their reputations. A culture of "information responsibility" will emerge.

"By 2020, it will be MUCH harder for people to remain anonymous online, but that

won't necessarily be due to tightened systems of identification. The loss of easy anonymity is more likely to result from increased accessibility to and wider use of improved tools for amateur forensic-style tracking of individuals. For better or for worse, privacy is going by the wayside. – **Mike Treder**, managing director, Institute for Ethics and Emerging Technologies

"By 2020 online anonymity will be largely a thing of the past, but not because people have been forced into disclosing their identity by pervasive authentication technologies. Indeed, there will be a strong and substantial reaction against being required to prove who we are in order to read a book, watch a movie or buy a cup of coffee (much less should criticisms at the government). Opportunities, technologies, and legal license will continue to protect anonymity. However, many people will in most circumstances elect to assert their identity in order to protect their own interests. Online banking, personal websites and social networks, etc., require that a person protect his or her identity. Where authentication is voluntary, and clearly in the client's interests, and non-pervasive, people will gladly accept the constraints. Just as they accept the constraint of using keys to lock the car and house door but have the prerogative to, if they wish, leave either unlocked." -- **Stephen Downes,** National Research Council, Canada

"The tension will continue and this one is more difficult. But online individuals will become more sophisticated, and thus more skilled in information management. A culture of information responsibility will grow where mismanagement of personal information will be a greater violation of cultural norms. Individuals will be empowered to challenge failed information management because historical errors will give cultural reference of the importance of proper information management." -- **Robert Cannon,** senior counsel for internet law at Federal Communications Commission

"I'm with Bruce Schneier on this one. The issue is less about anonymity, it's about accountability. Even avatars will have reputations. There will be some things that require a person's 'name' to be declared and validated, where the name could even be the

last legal record in a series of deed polls. What is far more important is the accountability. That a person 'identifiable' by some pattern (the simplest form of which is the avatar of choice) has his/her actions associated with the avatar, an audit trail as it were; that the reputational feedback loops are also associated with that avatar; that preferences and similar elected characteristics are published by choice, while profiles and behavioural data are published as the norm." – **JP Rangaswami,** Chief Scientist at BT and chair of Ribbit

"The right question has to do with maintaining autonomy, not anonymity. The way that the Internet treats identity must and will change. But, if the trust that makes the Internet serve our needs is to continue, then the users must own their identity outright. My identity is not your commodity. I must be able to tell my own story. This badly needs to be built into IP, and the phrase now used to describe the design problem, "user-centric digital identity," is hideous!" – **Garth Graham,** Board Member, Telecommunities Canada

"I absolutely believe that online anonymity will be relatively rare in 2020. Not necessarily because of bio-markers or scans, but because models of data analysis will generate new fingerprints - ones behavioral in nature. I believe that a company like Google, that has access to a wide swath of behavioral data - search logs, email traffic, and web visits across many domains - can actually create a new 'type' of fingerprint, a data fingerprint. As a result of these new forms of identification, online anonymity will be severely curtailed." -- **Fred Stutzman,** School of Information and Library Science, University of North Carolina-Chapel Hill

Users are not really tuned in to debates about privacy and anonymity and their indifference will allow others to set the policies.

"Global trends are pointing more toward the former than the latter. However where we ultimately end up is not fixed. It depends on whether we pay attention and act. If we want the second option to become true, there is still time to make it so if we get off our

behinds and lobby governments and global technical standards bodies, and push the services and platforms we use to make anonymity possible. Right now however the public is paying insufficient attention to these issues and a combination of law enforcement and advertising-driven business is carrying us blindly toward the former." -- **Rebecca MacKinnon**, Princeton Center for Information Technology Policy

Challenges to privacy come from different directions in different places. In democracies and advanced industrial nations, businesses demand to know who you are. In authoritarian regimes, the government wants to know.

"The battle over online anonymity is much like the tug-of-war between large copyright holders and online 'pirates.' It'll never end. Several kinds of people feel they have too much at stake to let other people hide online: besides movie studios and record labels, that would include law enforcement officials, national security agencies and marketers of all descriptions. At least some of the time, bad behavior (or suspected bad behavior) will trump any rationale for hiding identities. On the flip side, many of us actually want to be tracked down online so we can give up enough privacy to be sold things that are just right for us. Digital technologies keep the game in motion. As soon as one side builds a better mousetrap, the other side will hack it and the cycle starts again. Ironically, I think anonymity will remain just as endangered in free-market democracies as in authoritarian regimes. That's because in countries like Canada and the United States, we take it for granted that the State will not attempt to harm us or curtail our freedoms, online or offline - to say nothing of knee-jerk reactions to widely feared activities like terrorism. As for the marketers, they have a double advantage in using or circumventing ID systems. First, free-market economies are very forgiving of intrusive behaviors, if they can be construed as promoting growth or innovation. Second, and most importantly, the right to anonymity is a privilege of sophisticated and attentive citizens. The evidence may show otherwise, but I suspect that millions of mainstream onliners are too baffled or careless to remain vigilant about their privacy. Simply keeping up with the ever-changing rules on social networking platforms like Facebook is a task most

people appear unwilling to take on." -- **David Ellis,** York University, Toronto

Final thought: The online world mirrors the offline world – and always will.

"Choice about whether or not to divulge personal information will not be substantially different from the physical world. One does not have to divulge one's name to look in a store, but of course the store will want to know how they are to get paid. Nor does a newspaper (or website) have to publish content from unknown/unverifiable sources. And yes, there will be graffiti online as well as on walls. Why would one think it will be different - unless, of course both the physical world and the online worlds move in that direction in tandem because of other shared imperatives." – **Heywood Sloane,** Managing Director, Bank Insurance & Securities Association

About

About the Pew Research Center's Internet & American Life Project

The Pew Research Center's Internet & American Life Project is one of seven projects that make up the Pew Research Center, a nonpartisan, nonprofit "fact tank" that provides information on the issues, attitudes and trends shaping America and the world. The Project produces reports exploring the impact of the Internet on families, communities, work and home, daily life, education, health care, and civic and political life. The Project aims to be an authoritative source on the evolution of the Internet through surveys that examine how Americans use the Internet and how their activities affect their lives.

The Pew Internet Project takes no positions on policy issues related to the Internet or other communications technologies. It does not endorse technologies, industry sectors, companies, nonprofit organizations, or individuals.

URL: http://pewinternet.org

About the Imagining the Internet Center at Elon University

The Imagining the Internet Center's mission is to explore and provide insights into emerging network innovations, global development, dynamics, diffusion and governance. Its research holds a mirror to humanity's use of communications technologies, informs policy development, exposes potential futures and provides a historic record. It works to illuminate issues in order to serve the greater good, making its work public, free and open. The center is a network of Elon University faculty, students, staff, alumni, advisers and friends working to identify, explore and engage with the challenges and opportunities of evolving communications forms and issues. They

investigate the tangible and potential pros and cons of new-media channels through active research. Among the spectrum of issues addressed are power, politics, privacy, property, augmented and virtual reality, control and the rapid changes spurred by accelerating technology.

The Imagining the Internet Center sponsors work that brings people together to share their visions for the future of communications and the future of the world.

URL: http://imaginingtheinternet.org

Methodology

The survey results are based on a non-random online sample of 895 internet experts and other internet users, recruited via email invitation, Twitter or Facebook from the Pew Research Center's Internet & American Life Project and Elon University. Since the data are based on a non-random sample, a margin of error cannot be computed, and the results are not projectable to any population other than the experts in this sample.