NET DEPENDENCE: TECHNOLOGY, MEMORY AND KNOWLEDGE ABOUT HISTORY

JACK JEDWAB

Jack Jedwab is the President and CEO of the Association for Canadian Studies and the Canadian Institute for Identities and Migration. Holding a PhD in Canadian History from Concordia University, he taught at Université du Québec à Montréal and McGill University. He taught courses on the history of immigration in Quebec, on ethnic minorities in Quebec, on official language minorities in Canada and on sport in Canada. He has also written essays for books, journals and newspapers across the country, in addition to being the author of various publications and government reports on issues of immigration, multiculturalism, human rights and official languages. He is a frequent media commentator on politics, public policy, history and culture.

There is an important connection between acquiring knowledge, memory and learning. Learning involves the accumulating of new knowledge and/or skills while memory is the means by which information is encoded, consolidated and retrieved. In effect, we store some information in our brain for longer-term retention without which it is likely such information is not learned. Hence, the close ties between remembering something and learning about it.

Technologies have altered the way in which we acquire knowledge by increasingly enabling us to offload information that might be otherwise stored in our brain (whether it's names, phone numbers, appointments, birthdays, geographic locations and/or key events). Things that many of us once recalled are now easily accessed via the Internet on our computers, tablets and smart phones. Researchers Evan F. Risko and Sam Gilbert introduced the term "cognitive offloading" to describe "...the use of physical action to alter the information processing requirements of a task in order to reduce cognitive demand." According to Risko and Gilbert, if you used a smartphone to remind you of an upcoming appointment, you have engaged in cognitive offloading.

Offloading information is by no means new. For some time, we've used calculators to do our finances and used calendars to keep track of key dates. Before the advent of the Internet, the encyclopedia was perhaps the closest approximation for efficiently accessing collective knowledge. But it offered little portability. The big difference with the Internet is the massive amount of information available and the types of offloading it permits. It offers simple access to an endless and ever-changing storehouse of collective knowledge and the capacity to locate and learn seemingly any fact one desires.

Though it may seem as if constant access to a limitless knowledge should improve cognition, much has been written about how the rapidly changing landscape of technology affects what and how we remember people, places and events. And while some researchers believe that offloading hurts our memory, others believe the technological advances enable us to substitute the information previously stored with other things we may regard as relevant. As a consequence, the technologies that we have at our disposal permit the reprioritizing of information we store in the brain without necessarily affecting some "cognitive limit".

Does the ability to offload information about people, places and events have an impact on learning about the past and other related subjects? The interpretation of the past is closely linked to the ability to remember people, places and events, and therefore the ability to offload such information lessens the need to retain it. The impact of technological advances on memory is an area of inquiry that remains insufficiently examined and thus merits far greater attention than it has received to this point. It may also be a key question for history educators, who face diverse challenges in their ongoing effort to impart knowledge to students. As a contribution to the growing conversation over how technologies affect the relationship between memory, knowledge and learning, in August 2018, the Association for Canadian Studies commissioned the firm Leger Marketing to conduct a detailed survey of Canadian opinion on several key questions arising from this issue. Leger Marketing consulted 1,503 Canadians across the country during the week of Aug. 27, 2018, with a probabilistic margin of error of 3.5 percentage points 19 times out of 20. The sample included some 403 Quebecers, with 86 surveyed in English and 317 in French.

In their study of smart phone use, Wilmer et al. note that as "portable media devices have become increasingly pervasive in our daily lives they have become increasingly capable of supplementing or supplanting various mental functions... (and) seem capable of performing an almost limitless range of cognitive activities for us, and of satisfying many of our affective urges." They add that much of the literature in this area consists of quasi-experimental and correlational studies, from which there is no causality (in other words, we can't be certain about the impact of technological dependence). The few experimental studies that have been performed in this area typically investigate temporary rather than longer-term impact of extensive use of technology.

Our objective is not to look at the impact on cognition of varying uses of technology. Therefore, the national opinion survey is by no means a substitute for a clinical test of how technology affects memory and learning. Rather, it is an inquiry into how people perceive this relationship. As such, Canadians are being surveyed about their overall

reliance on technologies, their own dependence on technologies to retrieve information, whether they think the technologies are "smarter" than people and whether they see artificial intelligence (AI) as a source of positive change for society.

MEMORY

Research by Benjamin Storm et al. revealed that using a certain method for fact finding has a marked influence on the probability of future repeat behaviour. Thus, the more people use the Internet to support and extend their memory, the more they become reliant on it for securing information. Risko and Gilbert found that people will use technology when they believe it is superior to their own capabilities. The ACS-Leger survey found that some three in four Canadians agree (31% strongly agree and 43% somewhat agree) that "technology is becoming increasingly smarter than people." Nearly nine in 10 Canadians agree (42% strongly agree and 46% somewhat agree) that "people rely too much on technology as opposed to their own knowledge." There is a clear correlation in the extent to which people think that technology is smarter than people and agreement over whether there is too much reliance on technology as opposed to our own knowledge. As observed below, nearly two in three Canadians who strongly agree that technology is smarter than people are more likely to strongly agree that we're overly reliant on it.

TABLE 1: LEVEL OF AGREEMENT AS TO WHETHER "TECHNOLOGY IS BECOMING INCREASINGLY SMARTER THAN PEOPLE" AND EXTENT TO WHICH CANADIANS STRONGLY AGREE THAT "PEOPLE RELY TOO MUCH ON TECHNOLOGY AS OPPOSED TO THEIR OWN KNOWLEDGE"

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
Strongly agree: People rely too much on technology as opposed to their own knowledge	64.3%	34.6%	25.4%	33.3%

As noted, some observers are persuaded that frequent offloading of information to the Internet will end up eroding memory. To reiterate, the findings we offer are not a causal test of that relationship, but do reveal the degree to which people believe this is the case. In what might be described as a memory self-assessment, the survey shows that most Canadians agree that their memory is not as good as it used to be. That is especially the case amongst the older generation, with some seven in 10 persons over the age of 65 in agreement. As observed in the table below, some seven in 10 Canadian respondents agreed with the assertion that "with the Internet and technology, they don't need to remember as much as they used to." But there is a considerable gap amongst those under the age of 35 in the memory self-assessment and the perceived effect of the Internet on memory.

TABLE 2: AGREEMENT THAT "MY MEMORY IS NOT AS GOOD AS IT USED TO BE" BY AGE COHORT

	Total	18-24	25-34	35-44	45-54	55-64	65 +
My memory is not as good as it used to be	62%	47%	54%	63%	62%	67%	70%
Thanks to the Internet and technology, I don't need to remember as much as I used to	69%	74%	82%	72%	66%	63%	63%

Below, we look at the relationship between the two and observe that those most strongly in agreement with the idea that thanks to the Internet and technology they need not remember as much as they used to, is the group most likely to give weaker self-assessments of their memory. On the other hand, those most likely to disagree with the impact of technology on their memory are also least inclined to agree that their memory is not as good as it used to be.

TABLE 3: PERCEIVED IMPACT ON THE INTERNET AND TECHNOLOGY TO REMEMBER AS MUCH AS I USED TO AND SELF-ASSESSMENT OF MEMORY

	Thanks to the Internet and technology, I don't need to remember as much as I used to:			
My memory is not as good as it used to be:	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
Strongly agree	35.2%	16.7%	10.6%	9.4%
Somewhat agree	35.2%	51.2%	39.1%	34.4%
Somewhat disagree	15.7%	23.0%	33.2%	22.7%
Strongly disagree	12.6%	7.2%	16.1%	29.7%
I don't know	1.1%	1.8%	0.9%	3.9%

TECHNOLOGY DEPENDENCE

Nearly half of Canadians surveyed agree that they feel helpless when they don't have access to the Internet. Such dependence diminishes most for those persons over the age of 65. Some 45% of Can-

adians say they feel helpless when their mobile phone has no battery power. Those under the age of 25 are somewhat more likely to feel helpless without their cell phone than without access to the Internet (bearing in mind the connection between the two) whereas those over the age of 35 are more helpless when they do not have access to the Internet.

TABLE 4: AGREEMENT THAT I FEEL HELPLESS WHEN I DO NOT HAVE ACCESS TO THE INTERNET… AND… WHEN MY MOBILE PHONE HAS NO BATTERY BY AGE COHORT

Strongly and somewhat agree that I feel helpless…	Total	18-24	25-34	35-44	45-54	55-64	65 +
… when I do not have access to the Internet	50%	58%	61%	50%	54%	45%	38%
… when my mobile phone has no battery	45%	60%	64%	48%	48%	33%	28%

Above, we briefly examined the perception of helplessness amongst Canadians in the event of being cut off from the Internet and/or having a dysfunctional cell phone. Below, we look at various areas (appointments, birthdays, geography, passwords and key dates in history) where Canadians feel dependent on technologies or the Internet to act as their memory. In each of the areas identified in the table below, the majority of Canadians describe themselves as very or somewhat dependent. Not surprisingly, the survey reveals that technology dependence diminishes most after 65 years of age, though there are important gaps after 45 years of age as regards the recollection of key dates in history and getting around the city.

TABLE 5: HOW DEPENDENT ARE YOU ON TECHNOLOGY OR THE INTERNET TO REMEMBER THE FOLLOWING? (VERY AND SOMEWHAT DEPENDENT COMBINED PERCENTAGE)

	Total	18-24	25-34	35-44	45-54	55-64	65 +
Appointment times/dates	54%	65%	64%	60%	54%	54%	34%
Birthdays of close friends and/or family members	51%	61%	65%	56%	45%	51%	36%
Getting around the city	53%	72%	66%	62%	53%	48%	33%
Online passwords/logins	56%	63%	65%	56%	54%	51%	50%
Key dates in history	57%	73%	73%	63%	53%	48%	43%

On being dependent on technologies and the Internet to remember key dates in history, those Canadians who are most dependent are the ones who feel they don't need to remember as much as they used to. Similarly, those Canadians most inclined to agree that technology is becoming smarter than people are most dependent on technologies and the Internet for remembering key dates in history.

TABLE 6: VERY OR SOMEWHAT DEPENDENT ON TECHNOLOGIES AND THE INTERNET FOR REMEMBERING KEY DATES IN HISTORY AND PERCEIVED IMPACT OF TECHNOLOGY ON REMEMBERING AND AROUND PERCEPTION THAT TECHNOLOGY IS SMARTER THAN PEOPLE

	Very or somewhat dependent on technologies and the Internet for remembering key dates in history			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
Thanks to the Internet and technology I don't need to remember as much as I used to	74.4%	49.9%	45.2%	41.1%
Technology is becoming increasingly smarter than people	63.7%	60.4%	44.9%	43%

OFFLOADING INTELLIGENCE

In a recent consultation conducted by Pew Research, a number of experts predicted that artificial intelligence would augment human capacities, while others believe that "people's deepening dependence on machine-driven networks will erode their abilities to think for themselves, take action independent of automated systems and interact effectively with other."

As observed below there is a rather substantial difference in the degree to which Canadians under the age of 35 and those over 35 use voice-assisted technologies.

TABLE 7: USE VOICE ASSISTED TECHNOLOGY (E.G., SIRI, ALEXA) TO FIND INFORMATION ABOUT PEOPLE OR EVENT

	Total	18-24	25-34	35-44	45-54	55-64	65 +
TOTAL YES	23%	41%	37%	23%	20%	23%	6%
TOTAL NO	76%	58%	63%	76%	79%	76%	92%
I prefer not to answer	1%	1%	0%	1%	1%	1%	2%

The ACS-Leger survey does not directly address whether dependence on technologies is viewed negatively. However, the survey does include a question on the perceived impact of AI on society. At 43%, most Canadians agree that artificial intelligence (e.g. Siri and Alexa) is a source of hope and positive change for society, versus some 28% who see AI as a source of fear or a threat to society. Another 29% said they didn't know (many of them were likely unfamiliar with AI). There is yet another considerable gap on the basis of age in the extent to which people feel AI is a source of positive change for society. The table below also reveals that older Canadians are far more likely to say they don't know when asked about the societal benefits of AI.

TABLE 8: ARTIFICIAL INTELLIGENCE AS A SOURCE OF POSITIVE CHANGE OR FEARS OR THREATS TO SOCIETY BY AGE COHORT

Which of the following statements is closest to your opinion:	Total	18-24	25-34	35-44	45-54	55-64	65 +
Technologies, such as artificial intelligence and personal assistants (such as Siri and Alexa) are a source of hope and positive change for society	43%	53%	59%	41%	39%	42%	32%
Technologies, such as artificial intelligence and PDAs (such as Siri and Alexa) are a source of fears or threats to society	28%	28%	27%	36%	30%	26%	23%
I don't know	29%	19%	13%	23%	31%	32%	45%

The ACS-Leger survey further reveals that those Canadians in agreement with the idea that people rely on technology over personal knowledge are more divided over the societal merits of AI. As seen in the Table below, it is those feeling that people are less reliant on AI who seem more enthusiastic about its potential for positive societal change. In effect, more than seven in 10 Canadians who strongly disagree with the idea that people rely too much on technology believe that AI has a positive impact on society.

TABLE 9: RESPONSE TO "PEOPLE RELY TOO MUCH ON TECHNOLOGY AS OPPOSED TO THEIR OWN KNOWLEDGE" AND "… ARTIFICIAL INTELLIGENCE AS A SOURCE OF POSITIVE CHANGE OR FEARS OR THREATS TO SOCIETY…"

	People rely too much on technology as opposed to their own knowledge			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
Technologies, such as artificial intelligence (i.e. Siri and Alexa) are a source of hope and positive change for society	35.6%	45.9%	62.0%	71.0%
Technologies, such as artificial intelligence (i.e. Siri and Alexa) are a source of fears or threats to society	37.0%	24.7%	10.9%	16.1%
I don't know	27.5%	29.4%	27.1%	12.9%

It's the most frequent users of AI who are the most positive about its capacity. This may imply that greater familiarity with AI results in more positive views around its benefits. This may also be a function of a digital divide on the basis of age when it comes to AI; a deeper dive into the survey data reveals that amongst persons aged 55-64 who never use AI are those most likely to believe the negative outweighs the positive in terms of societal change when it comes to AI, or to simply affirm that they don't know.

TABLE 10: FREQUENCY OF USE OF VOICE ASSISTANTS AND RESPONSES TO "… ARTIFICIAL INTELLIGENCE AS A SOURCE OF POSITIVE CHANGE OR FEARS OR THREATS TO SOCIETY…"

Use Voice Assisted Technology (e.g., Siri, Alexa) to find information about people or events	Often	Sometimes	Rarely	Never
Technologies, such as artificial intelligence (i.e. Siri and Alexa) are a source of hope and positive change for society	74.3%	72.1%	57.0%	25.9%
Technologies, such as artificial intelligence (i.e. Siri and Alexa) are a source of fears or threats to society	14.9%	15.6%	23.8%	35.9%
I don't know	10.9%	12.3%	19.2%	38.2%

BACK TO HISTORY

The opinion survey strongly infers a link between dependence on remembering key dates in history and the use of voice assisted technology to find information about people and events. In effect, the technology used to secure information will probably impact the degree of dependence. The table below reveals that some 56% of Canadians who often use Voice Assisted Technology (e.g., Siri, Alexa) to find information about people or events are very dependent on technologies and the Internet for remembering key dates in history. In the case of those who often access an online encyclopedia (in this case Wikipedia, at one-third), the degree of dependence for remembering key dates in history amongst the most frequent Wikipedia users is considerably less than it is amongst those using Voice Assisted Technologies.

TABLE 11: FREQUENCY OF USE OF VOICE ASSISTED TECHNOLOGY VERSUS USE OF WIKIPEDIA AND EXTENT TO WHICH CANADIANS ARE VERY DEPENDENT ON TECHNOLOGIES AND THE INTERNET TO REMEMBER KEY DATES IN HISTORY

	Voice Assisted Technology (e.g., Siri, Alexa) to find information about people or events	Use Wikipedia to find information about people or events
Often	55.9%	33.1%
Sometimes	28.2%	22.5%
Rarely	22.8%	17.8%
Never	17.8%	12.3%

The table below reaffirms that age is not a key consideration in the extent to which voice-assisted technologies are used to remember key dates in history. The most frequent users aged 35-44 are far more likely to be dependent than those of the same age cohort who tend to use the voice assistants less frequently.

TABLE 12: USE VOICE ASSISTED TECHNOLOGY (E.G., SIRI, ALEXA) TO FIND INFORMATION ABOUT PEOPLE OR EVENTS AND DEPENDENCE ON TECHNOLOGIES AND THE INTERNET TO REMEMBER KEY DATES IN HISTORY

Between 35 and 44	Use Voice Assisted Technology (e.g., Siri, Alexa) to find information about people or events			
Key dates in history	Often	Sometimes	Rarely	Never
Very dependent	68.8%	34.1%	25.8%	17.9%
Somewhat dependent	12.5%	41.5%	41.9%	36.6%
Not very dependent	6.2%	22.0%	17.7%	30.1%
Not dependent at all	12.5%	2.4%	14.5%	15.4%
TOTAL	100.0%	100.0%	100.0%	100.0%

CONCLUSION

The survey results analyzed above suggest that the public believes that technologies and the Internet are having an impact on their need and capacity to recall various things that were often the object of memorization. The public perception around the relationship between use of technology and declining memory may be incorrect, as the perception needs to be tested with behavioral evidence. Still, it is clear that dependence on technologies to remember names, places and dates will have an impact on the retention of information. The question that arises, therefore, is whether the offload of such information impacts its retention and whether, in turn, this affects learning. With increasingly unparalleled information only a click or vocal command away, the need to remember facts and figures seems less vital to our daily routine. In the particular case of learning about the past, further testing will be required to determine what, if any, are the cognitive effects of reliance/dependence on external sources for securing information.

REFERENCES

Benjamin C. Storm, Sean M. Stone, Aaron S. Benjamin. "Using the Internet to access information inflates future use of the Internet to access other information". *Memory*, 2016; 1 DOI: 10.1080/09658211.2016.1210171

Evan F. Risko and Sam J. Gilbert. "Cognitive Offloading" Department of Psychology, University of Waterloo, Waterloo, Canada and Institute of Cognitive Neuroscience, University College London, London, UK

Evan F. Risko, Sam J.Gilbert. Cognitive Offloading As cited in Trends in Cognitive Sciences, Volume 20, Issue 9, September 2016, Pages 676-688

"Cognitive offloading: How the Internet is increasingly taking over human memory." ScienceDaily, 16 August 2016. Taylor & Francis. www.sciencedaily.com/releases/2016/08/160816085029.htm.

Henry H. Wilmer, Lauren E. Sherman and Jason M. Chein. "Smartphones and Cognition: A Review of Research Exploring the Links between Mobile Technology Habits and Cognitive Functioning" Front. Psychol., 25 April 2017 | https://doi.org/10.3389/fpsyg.2017.00605

Janna Anderson, Lee Rainie and Alex Luchsinger, "Artificial Intelligence and the Future of Humans" Pew Research, December 10, 2018

www.pewinternet.org/2018/12/10/artificial-intelligence-and-the-future-of-humans/