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A critical perspective on the mediatization of brain imaging and healthy ageing

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Abstract

Since the invention of functional brain imaging in the early 1990s, this instrumentally and computationally expensive methodology has captured our interests in visualizing the working mind, especially that of super-ageing brains. Because neuroimaging research is costly, various communication strategies are deployed to increase its visibility and fundraising success. Through a historical perspective on the representation of healthy ageing in the media, we examine the methods of communication (media logic) and the cultural interdependencies between media, research institutions, and health funding politics (mediatization), which magnify the profile of brain imaging in advancing the science of healthy ageing. Examples of hyped messaging about healthy-ageing brains underline the risk of visual ageism — a prejudiced and stereotypical view of what a good or bad older brain looks like. We argue that hyped mediatization can alienate older adults from participating in a line of research that might stigmatize them.

Keywords

Health communication; History of public communication of science; Science and media

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Introduction

The joint agenda of the World Health Organization (WHO) and the United Nation's for the Decade of Healthy Ageing (2021–2030) [WHO, 2021] signals global attention to the reality of the growing age of the world population. Thus, channels and languages with which media communicates and represents the scientific, cultural, and political responses to this agenda are paramount.

Neuroimaging, a three-decades young field of computational neuroscience, is an essential methodology for visualizing the brain ageing process. A large proportion of neuroimaging studies focus on identifying and predicting causes for age-related decline in mental capacity. Given the historical significance of rendering visible the interactions between body and mind, narratives of successful ageing created from neuroimaging evidence risk the creation of a new form of visual ageism. Loos and

Ivan [2018, p. 163] coined the notion "visual ageism" defined as follows: "the social practice of visually underrepresenting older people or misrepresenting them in a prejudiced way", including not only negative but also positive images. Indeed, a google-image search of "healthy ageing" returns photos of older adults running marathons, in yoga poses in the nature, or hiking, biking, playing music, or games. This, however, in and of itself can serve to stigmatize those who may not experience ageing in full functional health. Loos [2013] has argued that media representation of older adulthood by public authorities (e.g. websites) combines a positive message (to live a longer life in good health) with a warning (individuals are responsible for sustaining resources they need in later life, thus creating a positive bias to praise the "eternally youthful seniors" [Loos, 2013]. As the Google NGram illustrates (Figure 1), the interest in strategies for achieving successful and healthy ageing has considerably been growing these last decades.

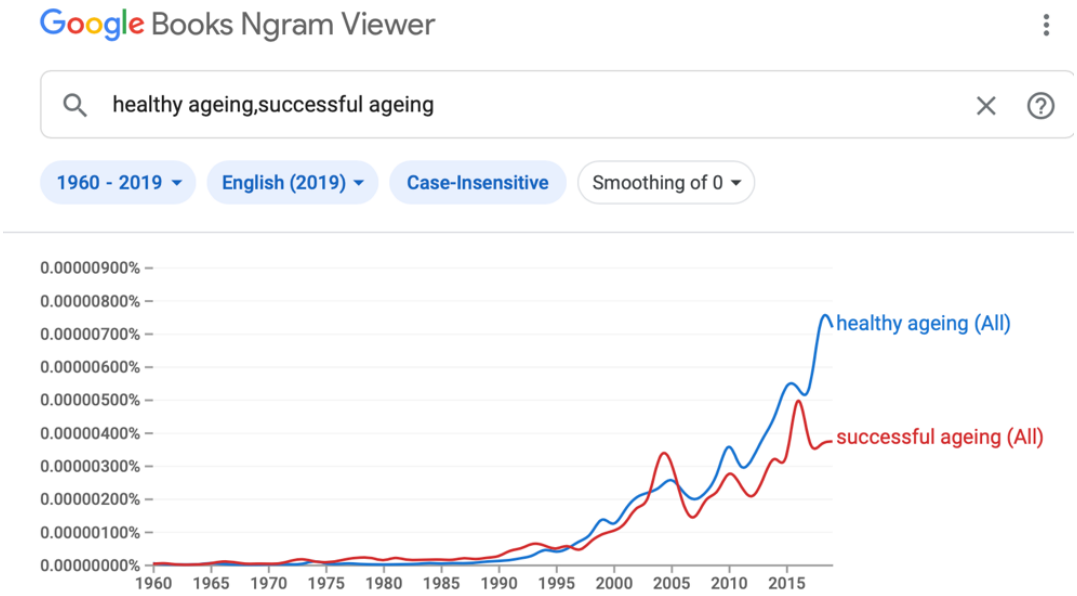

Figure 1. Google NGram diagram of the frequency of the terms "healthy ageing" and "successful ageing" (case-insensitive) in printed texts. The Y axis represents the rate with respect to all existing words.

A recent analysis of the portrayal of older adults on the website of organizations in the Netherlands, Sweden and, the UK illustrates that visual ageism still exists, especially in terms of a differential representation of third-agers (healthy and active gray-haired individuals) and fourth-agers (requiring assistance) [Loos et al., 2022]. The media logic in the organizational representation of ageing is set to attract the stakeholders' support for investment into providing good care. Both positive and negative media representations of ageing have cultural consequences.

For example, in their examination of discourses within a Canadian newspaper (*The Globe and Mail*) researchers found that the majority of articles created negative stereotypes of ageing that prevented older adults from seeking help when they needed it [Fraser, Kenyon, Lagacé, Wittich & Southall, 2016]. A more recent analysis of 119 Canadian news articles covering five Canadian disasters, Oostlander and colleagues found that the stereotypes applied to older adults were on a positive-negative spectrum and observed examples of "compassionate intra- and intergenerational ageism, for example in the mismatch between the quotations

of older adults about their own conditions, and the journalist's interpretation of the situation [Oostlander, Champagne-Poirier & O'Sullivan, 2022].

Since the invention of functional neuroimaging methods in the early 1990s, this instrumentally and computationally expensive methodology has captured our interests and imaginations about visualization of the working mind [McCabe & Castel, 2008]. In a 2014 qualitative study of individuals with no background in brain sciences, O'Connor and Joffe demonstrated that the discussions of brain science were often overshadowed by common-sense (divorced from the science) and that a sense of anxiety permeated the discussions of brain science, especially more intense in those of older age [O'Connor & Joffe, 2014]. These authors also showed that in the individuals they interviewed, the promise of brain optimization and its role in preventing brain-related functional decline was received positively [O'Connor & Joffe, 2015]. It is not surprising then that large-scale epidemiological studies such as Alzheimer's Disease Neuroimaging study – ADNI are underway in the US [Jack et al., 2008], and efforts are replicated in countries like Iceland [Harris et al., 2007], Japan [Iwatsubo et al., 2018], Canada [Chertkow et al., 2019], and Australia [Sachdev et al., 2010], to name a few.

In a nutshell, neuroimaging studies of healthy ageing seek to render visible the anatomical and functional changes of the brain in normal and 'pathological' ageing [e.g. Yin et al., 2023; or Hunt et al., 1989; Salat, Kaye & Janowsky, 1999]. These studies are costly as they rely on highly specialized infrastructure, specialized expertise, and volunteers who consent to participate in research. The procurement of these resources requires effective communication strategies that increase visibility and raise the stakes of such research to facilitate fundraising. It is then plausible to question the cultural outcome that emerges through recursive interactions between media, research institutions and health policy in reporting the significance of brain imaging in promoting the science of healthy ageing.

The aim of this analysis is to examine how the media communication of neuroimaging studies, as well as the institutional media strategies create a cultural shift in the meaning of healthy ageing. We use the theoretical framework of mediatization to assess the risk of 'visual ageism' arising from the hyped reporting of brain imaging discoveries related to healthy ageing.

Media logic and mediatization in the context of science communication

The transactional relationships between cultural, economic, or political environments in which the media influences organizations or knowledge is called *mediatization* [Hepp, Hjarvard & Lundby, 2010]. According to Hajvard, "contemporary society is permeated by the media, to the extent that the media may no longer be conceived of as being separate from cultural and other social institutions" [p. 105]. From this perspective, the media is an entity that is embedded in the institution's operations to such extent that the institutions are forced to submit to their logic. As such, Hjavard emphasizes that mediatization needs to be understood as a societal process that contributes to both "disembedding social relations from existing contexts and re-embedding them in new social contexts" [Hjarvard, 2008]. Hjavard's theoretical conceptualization for mediatization is useful, especially as it allows to replace the cultural backdrop from religion (as a source of authority made visible by the media) [Hjarvard, 2016] to science as a substitute for the authority of religion.

Media plays a vital role in the mobilization of health information, and its sphere of influence surpasses traditional and institutional health expertise [Christensen, 2016; Institute of Medicine, 2003]. In targeting older adults to receive health-related communications, marketing researchers have shown that positive framing of ageing contributes to greater acceptance of the messaging content [Jayanti, 2010].

Mediatization of science not only influences individuals (e.g., concerning health-related information), but also institutions (e.g., their priorities). Peter Weingart [2012] offers a conceptual framework for mediatization of science that emphasizes the coupling between media and science in terms of fundraising. In Weingart's view, "the science system is coupled to the system of politics because it provides knowledge for decision making and legitimacy in exchange for public funds" [p. 30]. In other words, the media is a key distributor of scientific knowledge in as far as it empowers and gives legitimacy to the governments, but in this relationship, science may have to compete or even be replaced by knowledge produced by religious institutions. As such, mediatization of science tends to orient science towards media interests, aiming to increase visibility, gain public support, and secure the public legitimacy for science to incentivize the political support in funding [Franzen, Weingart & Rödder, 2012].

All organizations that strive for a global interface need to adopt a media logic that gains them visibility and interest for sustenance. Altheide defined *media logic* as a form of communication and the process through which media transmit and communicate information [Altheide, 2016]. In Altheide's definition, events, actions, and actors' performances are governed by information technologies, specific media, and communication formats. In general, media logic (including technologies, processes, aesthetics, formats, and organizational elements) shapes the production of the media content [Mazzoleni & Splendore, 2018]. The media logic that subserves the mediatization of science includes several components that generate different content but reinforce one another. These include promotional communications that raise the profile of researchers (e.g., resumes, websites, or Wikipedia entries); press releases that draw attention to success of researchers (e.g., successful grant applications, institutional press releases on new publications of research findings); and knowledge mobilization campaigns through media interviews on scientific trends, ted-talks, op-eds, or books written with the aim of knowledge translation for the non-academic audiences. There are also academic tools such as peer-reviewed research articles or data-visualization and dissemination strategies for scientific communication. As such, the media logic changes with targeted objectives but remains on the target of focusing on increasing legitimacy and fundraising for the scientific agenda.

In the following sections, we focus on various aspects of the media logic of neuroimaging to provide examples of how the mediatization of neuroimaging contributes to cultural shifts in the meaning of healthy ageing.

The role of media in making the science of healthy ageing visible

Since its establishment as a field of inquiry in 1967, neuroscience has claimed a privileged position in the media coverage of ageing sciences. In 1968, an influential discovery by Bruce McEwen showed that brain regions that were important for memory (and thus for Alzheimer's research) were affected by stress hormones. Announcing his passing, New York Times explained his legacy: "their discoveries,

first published in the journal Nature in 1968, ignited a new field of research, one that would reveal how stress hormones and other mediators change the brain, alter behavior and impact health, in some cases accelerating disease" [Hutter Epstein, 2020].

In mid 80's, publications of McEwen (more than 1,000 published works) would start to include theoretical and conceptual frameworks about the biological underpinnings of ageing mainly based on evidence from effects of chronic stress on the brain cells of experimental rats [McEwen et al., 1987; Sapolsky, Krey & McEwen, 1986]. These pioneering studies illustrated that not only differences in brain ageing are related to life conditions, but also that the brain is plastic and adaptable and thus it is possible to reverse or slow down this process. A New York Times Articles (*The Will to Stay Well*, April 17 1988 by Blair Justice) quoting several scientists, including McEwen promoted the idea that a healthy mind and brain function would improve the immune system, and hoped that "noninvasive imaging devices as PET (positron emission tomography) and M.R.I. (magnetic resonance imaging) [would be] helping to give researchers precise images and greater understanding of brain activity, [thus] making it easier for scientists to explain the effects of psychological and social factors on disease" [Justice, 1988].

Responding to the public interest, non-academic books such as *Hostage Brain* [McEwen & Schmeck, 1994] and *The End of Stress as We Know It* [McEwen & Lasley, 2002], as well as popular books by his equally influential students, such as Sonia Lupien, the author of *Par Amour du Stress* [Lupien, 2012] (pioneer in linking brain imaging to stress-related cognitive decline with age) have created a pervasive school of thinking that seeks to identify risk factors that accelerate age-related deficits in cognition and promotes adaptive self-care strategies for achieving successful ageing.

In examining the mediatization of healthy ageing, Christensen asks: does a normative representation of healthy ageing in media [through the lens of neuroimaging sciences] help older adults to be informed, is it ignored and treated with skepticism, or does it pose a psychological threat to those who do not want to, or are not able to age successfully? [Christensen, 2017]. A well-recognized difficulty with the promotion of 'healthy ageing' is that in drawing attention to the fact that some people age better than others, a 'deficit' narrative perpetuates ageist stereotypes in the media [Fraser et al., 2016; Loos & Ivan, 2018; Zhang & Liu, 2021], in science [Lupien & Wan, 2004] and in politics [Loos & Thijssen, 2022]. In other words, the mediatization of 'ageing as vulnerability' produces a cultural milieu in which not ageing successfully becomes stressful itself and creates self-ageism [Levy, Chang, Lowe, Provolo & Slade, 2022]. This can create an environment in which older adults do not feel safe to contribute and participate in research [Cavill & Foster, 2018; Khalili-Mahani & Sawchuk, 2022].

Media hype around the neuroimaging studies of super-agers

Neuroimaging produces aesthetically pleasing images: brain networks depicted in colours, activation maps, and the beautiful anatomy of the brain structures, which are created through complex computational models. While these images are impressive to look at, they are hard to interpret, and the discussions of research publications are often careful to describe in detail the limited scopes of interpretations and conclusions that can be drawn. However, brain images are

attractive assets for science news. Sensational media headlines attract audiences and mutually benefit the media outlet (by increasing their rating) and the scientists (by raising their profiles). Amplification of findings can inflate citations and create (perhaps unwarranted) authority of the claims [Greenberg, 2009]. For example, the CBS's report on "*Brains of 'super-agers' look decades younger*" covered a modest neuroimaging study of surrogate markers for brain networks [Sun et al., 2016] whose interpretation is always contingent on the analysis techniques. However, the 'hot topic' takes shape in the media imagination. For example, undertaking a content analysis of the media coverage of a landmark neuroscience study of free will (published in 1983), Racine and colleagues illustrated that although the news coverage of the study acknowledged the methodological limitations, yet they exaggerated and misrepresented the findings [Racine, Nguyen, Saigle & Dubljevic, 2017]. van Atteveldt and colleagues have shown that the fidelity of media reporting of neuroscience is a function of timing and the wave, the topic, and also the quality and audience of the newspapers, concluding that overall, the accuracy of the reporting was low [van Atteveldt, van Aalderen-Smeets, Jacobi & Ruigrok, 2014].

While this problem is well known — that the misrepresentation of data can lead to misleading conclusions in the media [Gonon, Bezard & Boraud, 2011] — the incentive for attention-grabbing headlines seems irresistible. Take the title of a neuroimaging study published in the Journal Cerebral Cortex: *Greater Neural Differentiation in the Ventral Visual Cortex Is Associated with Youthful Memory in Superaging* [Katsumi, Andreano, Barrett, Dickerson & Touroutoglou, 2021]. The Harvard University's research press release heralded the news under the title "Exploring why some remain sharp even as decades roll by", and claimed that "researchers at Harvard Medical School and Massachusetts General Hospital are hot on the trail of elderly 'super-agers' — whose sharp memories avoid typical age-related declines — in an attempt to study whether there are interventions that can improve prospects for the rest of us" [Powell, 2022].

To 'visualize' the brain of healthy older adults, and compare them to the young, also creates the subtext for research institution's media outlet to advise on strategies to keep the brain young. Take for example The Harvard Medical School's Health Publishing site which provides the following headlines: "12 ways to keep your brain young" [2022], "Protecting memory: strategies for healthy brain aging" [2020], "Building a 'cognitive reserve' offers brain protection in old age" [Solan, 2022] and "Good genes are nice, but joy is better" [Mineo, 2017]. This promotional content generation is also present in mass media. For example, New York Times has a section dedicated only to the brain (https://www.nytimes.com/topic/subject/brain). Searching the topic archives for titles related to "Ageing", returns 943 (as of Oct 28, 2022) entries, with the latest ones covering "What Types of Exercise Reduce Dementia Risk?" or "New Dementia Prevention Method May Be Behavioral, Not Prescribed".

In a Nature Neuroscience Review, Illes and colleagues reviewed and listed several reasons why the communication of neuroscience by media may be problematic [Illes et al., 2010]. Chief reasons include the complexity of the brain sciences and the difficulty of communicating highly specialized research; the cultural biases that influence a selective interpretation of hard-to-interpret results; and most importantly the cost of hypes and hopes and the risks of generating stigma about brain-related differences. Neurology and Social Scientists have also written

extensively about unwarranted epistemological shifts created from mediatization of neuroscience [Rose & Abi-Rached, 2013; Tallis, 2016]. Gerontologists have also started taking a more critical view of their field [Gendron, 2022]. To what extent the mediatization of ageing through the lens of neuroimaging has shifted the cultural attitude towards getting old remains to be investigated.

Increasing the funding visibility increases the visibility of ageing as an expensive problem

Increasing media visibility for the purpose of sustaining research funding inevitably influences policy. Using international data from 1550 institutes in six countries, Entradas and Santos investigated the relationship between competitive funding and public communication across levels of excellence. They found that better-funded institutes advertised for their higher levels of excellence were also more visible in public communications [Entradas & Santos, 2021]. Assembling a dataset of the reviews of all funding decisions of grant proposals submitted in an extensive Dutch funding program, Bol and colleagues demonstrated the Mathew Effect (coined by American sociologist Robert Merton quoting Saint Mathew: "*For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath*") where early successes increase the future success [Bol, de Vaan & van de Rijt, 2018].

Besides press releases, institutional websites that attract public and private investment influence policy through promotion of a culture that is consistent with the research agenda.

Canada, as a large and resourceful country with a small population provides an excellent example of the ways in which the discourse of scanning the brains in search of discovering the biomarkers of healthy ageing mobilizes large funding initiatives by public and private stakeholders. As can be seen from their websites, Initiatives such as the Canadian Brain Strategy (https://canadianbrain.ca), and the Canadian Association for Neuroscience (https://can-acn.org) play a significant role in lobbying for additional investment by ensuring that support for brain research remains a top public priority. About the leadership, the website indicates membership of the heads of more than 30 neuroscience and mental health institutes and programs across the country who "oversee the delivery of information to their respective constituents and keep them fully apprised to ensure diverse representation in all [brain research] activities. As such, they bring input and commitment from large constituents of the Canadian brain research community".

Indeed, the lobby has been successful. The Government of Canada has granted several Canada First Research Excellence Fund (CFREF) to initiatives such as "Healthy Brains Healthy Lives" ($88M to McGill University), with a lion's share of this funding supporting the strength of the university in neurodegenerative diseases [Government of Canada, 2016]. Another recipient of such funds ($66M to Western University) leads a project entitled BrainScan (https://brainscan.uwo.ca) to consolidate the visualization of a healthy brain. The Mathew Effect in the case of such high-profile funding also creates 'charitable' foundations such as Brain Canada Foundation. According to Inez Jabalpurwala, the president, and CEO of Brain Canada, "a group of business and science leaders had a bold vision: to transform brain research in Canada". Then, based on the success of Canadian research leaders [especially in neuroimaging and neuroinformatics], "Brain Canada convinced the Government of Canada in 2011 to build the largest dedicated brain

research fund in Canadian history, named the Canada Brain Research Fund. Through this $240-million CAN public-private partnership, the Government of Canada, through Health Canada, is matching $120 million CAN raised by Brain Canada and its partners on a 1:1 basis" [Jabalpurwala, 2016]. Much of this funding has been dedicated to age-related neurodegenerative diseases [*Building better brain health: 2020–2021 impact report*, 2021].

Besides these government-connected advocacy groups, private funding contributes to the mediatization of brain sciences that focus on healthy ageing. For example, a $12M investment by the Weston Family to McMaster University aims to support a 6000-researcher network that pursues the question of "Healthy Brain, Healthy Ageing" [Lawson, 2021]. A sum-total of $77M funding supported by the Federal government in the Canadian Consortium for Neurodegeneration in Ageing (over ten years), plus another $24M pledge from partners in Quebec and Ontario [Government of Canada, 2014] are exclusively related to ageing neuroscience. The government of Ontario's $100M investment in Ontario Brain Institute ["Ontario Brain Institute: building innovation in brain research & care", n.d.] pursues similar missions. Neuroscience is not the only field that seeks funding for healthy ageing. Researchers in AGE-WELL network compete for much larger sums of money ($3B for implementation of technologies that will benefit older adults) ["Federal budget provides supports for older Canadians at home and in long-term care", 2021].

For research funding to continue to flow into these projects, it is crucial to, on the one hand, establish the reputation of researchers who lead them, but also to amplify the impending costs of unhealthy ageing to underline the priority of such investments in the public agenda.

From visualizing the ageing brain to 'Visual Ageism'

'Visual Ageism' is the consequence of well-intended media logic. It makes older adults visible either by creating positive images of those who sustain health through lifestyle or activity; or by creating negative stereotypes while raising awareness and sympathy about the needs of frail older adults [Ivan, Loos & Tudorie, 2020; Loos & Ivan, 2018; Loos et al., 2022]. Hence, the media logic of neuroimaging of ageing risks creating a similar form of visual ageism. Such implicit biases can be created by how the media promotes visualization of healthy ageing (e.g., by emphasizing the images of the brains of super-agers), or by magnifying the importance of brain-imaging sciences to make the process of brain ageing visible, through a media logic that magnifies the gravity of visibly quantifiable ageing process.

To visualize the brain that creates the consciousness and behavior has always been a sensational topic and a controversial one as well. Hence, it is not surprising that the press releases that bring high-impact neuroimaging findings to the public and policymakers embellish the results [Gonon et al., 2011; Marek et al., 2022]. Sensational representation of neuroimaging evidence for what constitutes a healthy brain in the ageing process contributes to new iconography of older adulthood, which as critical ageing studies have shown, has cultural and practical consequences for older adults [Fraser et al., 2016; Loos, 2018; Morgan, Wiles, Williams & Gott, 2021; Oostlander et al., 2022; Sourbati & Loos, 2019; Xu, 2021; Zhang & Liu, 2021].

It is critical to underline that images have the power to go beyond simple signifiers and to become the semiotics (how to represent the being old) that generate and reinforce meaning (good-old and bad-old) [Loos & Thijssen, 2022]. In fact, the negative mental health consequences of such media-generated stereotypes of older adults manifested during the COVID-19 pandemic [Levy et al., 2022]. Analysis of news media's coverage of older adults in New Zealand [Morgan et al., 2021] or China [Zhang & Liu, 2021] reported that the coverage of being old as an *inherent* vulnerability was more prevalent than the *situational* risks such as socioeconomic circumstances. In reality, the strongly medicalized coverage of older populations' vulnerability made them the target of insensitive jokes [Jimenez-Sotomayor, Gomez-Moreno & Soto-Perez-de-Celis, 2020; Xiang et al., 2021] or even social media #boomerRemover hashtags [Monahan, Macdonald, Lytle, Apriceno & Levy, 2020]. It can be imagined that popularization of the AI-powered neuroimaging to identify brain age [Yin et al., 2023], can have significant implications for what it means to be an ageing individual. Covering this research article in an IEEE-spectrum press release and under a sensational title (Figure 2), the press release quoted the senior author as saying: "if we do identify people at high risk early, we can mitigate the risk through lifestyle changes or potential treatments".

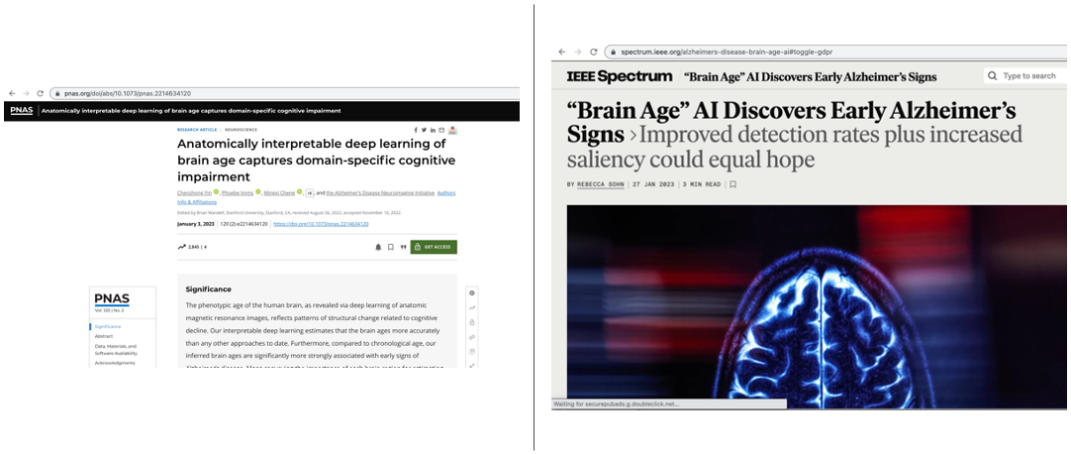

Figure 2. Research article title that is published in the prestigious Proceedings of National Academy of Science (on the left), is hyped in the sensational press release in an engineering news forum (on the right).

Conclusion

From an intersectional perspective attentive to recent trends in the science of ageing and media representation of healthy ageing, we have critically examined the media logic (methods), and the mediatization (cultural contexts) of neuroimaging sciences) that focus on making visible the healthy-ageing brain. The mediatization theory offers a framework to examine the three-way interactions between the media, politics, and science.

In this paper, we have specifically examined three aspects of the media logic of neuroimaging: public outreach and knowledge mobilization efforts by pioneering scientists who drew attention to the role of brain imaging in providing visible evidence for what a healthy and successfully ageing brain looks like; sensational media coverage of scientific findings of what the brain of super-agers looks like; and finally, institutional communication of the importance of fundraising for

neuroimaging which magnify the role of visualization of ageing brains as a first step in prediction and prevention of age-related deficits.

Because the evidence from neuroimaging studies can be rendered visually (e.g., the size of a brain region, or the intensity of brain activity in regions affected by age), mediatization of brain imaging contributes to a new visual semiology of what it means to age well or poorly. Given the increasing awareness about the impact of lifestyle and gene-environment interactions on the life-course of brain health, generating hype around neuroimaging runs several risks:

- Magnifying the significance of neuroimaging in solving the "problem" of ageing creates false expectations divorced from the existing scientific and methodological challenges that this field of research is yet to overcome. Hence, it discredits and gradually reduces the legitimacy of this line of research.
- Creating a discourse about observable differences in the super-ageing brains contributes to visual ageism. New stereotypes based on images of super-ageing brains can turn ageing into a reductionist outcome of lifestyle, biology and genes. In the absence of a proven preventive method, this deterministic view risks stigmatization and alienation of older adults from research that can benefit them.
- Raising the funding profile of research on ageing, turns older adulthood into a visible and very expensive problem. It makes being an unhealthy older adult into a shameful stage of life, especially at the times of economic austerity (as evidence gathered during COVID-19 supports).

Neither the media, nor science institutions act independently. These institutions collaborate on a media logic that increases the visibility of and funding for the neuroimaging studies of the ageing brain. While the motivation is to improve public health for the ageing population, the narratives about super-ageing brains may discourage those who fear stigmatization due to their age-related disabilities.

Several questions deserve our attention: to what extent has the mediatization of neuroimaging shifted the cultural discourse of healthy aging? To what extent has the mediatization of neuroimaging of healthy brains improved the quality of healthcare for older adults? To what extent are institutional communication officers aware of the history of the media-creation of brain-related stigma in general, and ageism in particular?

Adopting a media logic that avoids hype and oversimplification of complex neuroimaging studies may mitigate the risks of a new form of visual ageism and its unintended consequence: self-exclusion of stigmatized older adults from research studies that might benefit our public health.

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