Published in final edited form as:

AJOB Neurosci. 2019 ; 10(1): 23–25. doi:10.1080/21507740.2019.1595779.

Neurotechnologies cannot seize thoughts: a call for caution in nomenclature

Katherine E. MacDuffie¹, Sara Goering^{1,2}

¹University of Washington

²Center for Neurotechnology

Meynen (2019) offers the reader a thought exercise: imagine a future in which neurotechnologies for detecting mental states are applied in a forensic psychiatry setting. A broad range of examples of such technologies are offered, ranging from crude fMRI-based communication with patients in a vegetative state to brain-computer interfaces that allow for volitional movement of a robotic arm. Meynen collectively calls these approaches “neurotechnological thought apprehension (NTA)” — a somewhat provocative and (we argue) misleading label. The phrase *thought apprehension* implies an ability to perceive specific thoughts, which is beyond the scope of current technologies. While Meynen acknowledges that we are not yet capable of “real-time mind reading”, he still describes existing technologies as examples of NTA, and in doing so, misrepresents the state of the science. Authors of the original publications cited by Meynen describe their techniques as tools to “detect”, “identify”, “translate”, “capture”, or “classify” activation patterns in brain data (Monti et al. 2010; Mason & Just 2016, Soekadar et al. 2015, Leroy et al. 2017, Just et al. 2017; for full references see Meynen 2019). In contrast to these more neutral descriptors, the word *apprehension* (originating in the Latin word “apprehendere” which means to seize or grasp) invites a more sinister interpretation—that such techniques are capable of seizing the thoughts of unwitting human participants.

The notion of involuntary seizure of an individual’s private thoughts is central to Meynen’s argument. He describes as the core challenge of forensic psychiatry the unreliability of first-person reports, given the “increased risk of lying, malingering, and selective information sharing” in such settings. He argues correctly that a technology which could reveal a disconnect between a person’s inner thoughts and self-report (e.g., fMRI for lie detection) would appeal to evaluators in a forensic setting. However, Meynen makes a logical leap from describing in the same category techniques potentially capable of distinguishing a state of “lying” from “not lying” and ones capable of real-time mind reading. The ability to “read”, “perceive”, or “apprehend” naturally-occurring thoughts is considerably more challenging given the high variability in brain structure and function across individuals, and the difficulty of mapping an imprecise signal like electrical activity or blood flow onto the potentially infinite set of thoughts that could pass through a human brain in a given moment (Roelfsema, Denys, and Klink 2018). By lumping together technologies for “detecting” or “identifying”

specific neural activation patterns associated with cognitive states (e.g., lying) with those capable of “reading” or “apprehending” specific thoughts, Meynen obscures his argument. In doing so, he misses out on a potential opportunity to more clearly explicate the ethical challenges raised by application of neuroimaging in the forensic setting.

The label used by Meynen also has potential to do harm as a result of its connotations in popular culture. Technologies capable of “mind reading” have long fascinated science-fiction audiences given their chilling potential to rob an individual of private internal thoughts. Persecutory delusions, the most common type of delusion experienced by people with psychotic disorders (Cannon and Kramer 2012), often involve believing that one’s thoughts are being “apprehended” by another person or device. These types of delusions have increased in frequency in the past century, with specific content reflecting trends in emerging technologies (Škodlar et al. 2008, Cannon and Kramer 2012). These trends in delusion content parallel the growing public concern about the invasiveness of technology in modern life (Valentino-DeVries et al. 2018), which could undermine support of research at the frontiers of brain science. The use of terms like Meynen’s NTA in published works of scholarship may stoke these collective fears, with potential harms for psychiatrically-affected individuals as well as scientific progress. Scholars can be clear about real risks of advances in brain science and neurotechnologies without swaying public opinion towards suspicion and distrust through the use of unnecessarily provocative terms.

Word choice aside, Meynen’s most interesting ethical point (in our opinion) is the potential for neurotechnologies to reveal information about an individual that is outside of conscious awareness and thus may be exposed involuntarily. In a forensic setting, such a tool could be perceived as a useful workaround in cases where lying or malingering is suspected—but only if the tool has low face validity (i.e., the purpose of the test is not clear to the participant). Meynen makes the point that collection of valid data in any of the “NTA” techniques he describes would be nearly impossible with a non-compliant subject; a participant could simply refuse to lie still during a scan, for example, or spoil any neural data collected by thwarting task instructions or thinking about unrelated topics. In a forensic setting, therefore, it is difficult to imagine how coerced participation in a such an assessment would yield valid data. However, if the purpose of the test were not clear to the participant, it is possible that potentially-revealing information could be obtained without the participants’ awareness.

For decades, subliminal presentation of stimuli has been a tool of cognitive psychologists interested in the interplay between conscious and non-conscious processing. These methods have also been employed in neuroimaging studies, and subliminally-presented stimuli (particularly those that evoke strong emotions) reliably elicit activation across multiple modes of presentation (Brooks et al. 2012; Pegna et al. 2011). With current fMRI technology, subliminal presentation can reliably distinguish diagnostic groups (Grotegerd et al. 2014), and invoke activation in areas associated with sexual arousal (Wernicke et al. 2017), as well as empathic responses to pleasure/pain in others (Chiesa et al. 2017). If validated in larger samples, these techniques—more so than the examples Meynen described—show clear potential utility in the forensic setting for revealing psychiatric diagnoses, sexual preferences, and/or diminished empathy in individuals who might be motivated to lie

on self-report or thwart a more face-valid neural assessment. And because subliminal presentation, by definition, occurs without the conscious awareness of the individual, in our opinion these techniques pose the most significant ethical questions, particularly if they were to be used in contexts where deception about the purpose of an assessment, absence of informed consent, and coercion to participate are likely.

In conclusion, we believe that Meynen's choice of "NTA" nomenclature has three unfortunate effects: 1) misrepresenting the current state of the science, 2) invoking science-fiction-style notions of "thought seizing" which are scientifically implausible and potentially harmful, and 3) obscuring the unique challenges of the forensic setting (e.g., non-compliance) that could incentivize the application of specific techniques (e.g., subliminal fMRI) in ethically-questionable ways. The broader lesson we take is that words matter: as scholars, we should choose language that accurately reflects the scientific facts, precisely describes the ethical challenges unique to a given context and technique, and depicts a realistic vision of the future—one which highlights and explores potential risks without at the same time provoking unnecessary worry.

References

- Brooks SJ, Savov V, Allzén E, Benedict C, Fredriksson R, and Schiöth HB. 2012 "Exposure to Subliminal Arousing Stimuli Induces Robust Activation in the Amygdala, Hippocampus, Anterior Cingulate, Insular Cortex and Primary Visual Cortex: a Systematic Meta-Analysis of fMRI Studies." *Neuroimage* 59 (3): 2962–73. doi:10.1016/j.neuroimage.2011.09.077. [PubMed: 22001789]
- Cannon Brooke J, and Kramer Lorraine Masinos. 2012 "Delusion Content across the 20th Century in an American Psychiatric Hospital." *The International Journal of Social Psychiatry* 58 (3): 323–27. doi:10.1177/0020764010396413. [PubMed: 21421637]
- Chiesa Patrizia Andrea, Liuzza Marco Tullio, Macaluso Emiliano, and Aglioti Salvatore Maria. 2017 "Brain Activity Induced by Implicit Processing of Others' Pain and Pleasure." *Hum Brain Mapp* 38 (11). John Wiley & Sons, Ltd: 5562–76. doi:10.1002/hbm.23749. [PubMed: 28833833]
- Grotegerd Dominik, Stuhmann Anja, Kugel Harald, Schmidt Simone, Redlich Ronny, Zwanzger Peter, Rauch Astrid Veronika, et al. 2014 "Amygdala Excitability to Subliminally Presented Emotional Faces Distinguishes Unipolar and Bipolar Depression: an fMRI and Pattern Classification Study." *Hum Brain Mapp* 35 (7). John Wiley & Sons, Ltd: 2995–3007. doi:10.1002/hbm.22380. [PubMed: 24038516]
- Meynen Gerben. 2019 "Ethical Issues to Consider Before Introducing Neurotechnological Thought Apprehension in Psychiatry." *American Journal of Bioethics Neuroscience*.
- Pegna Alan J, Darque Alexandra, Berrut Claire, and Khateb Asaid. 2011 "Early ERP Modulation for Task-Irrelevant Subliminal Faces." *Frontiers in Psychology* 2 *Frontiers*: 88. doi:10.3389/fpsyg.2011.00088. [PubMed: 21687457]
- Roelfsema Pieter R, Denys Damiaan, and Klink P Christiaan. 2018 "Mind Reading and Writing: the Future of Neurotechnology." *Trends Cogn Sci* 22 (7): 598–610. doi:10.1016/j.tics.2018.04.001. [PubMed: 29729902]
- Škodlar B, Dernovšek MZ, and Kocmur M 2008 "Psychopathology of Schizophrenia in Ljubljana (Slovenia) From 1881 To 2000: Changes in the Content of Delusions in Schizophrenia Patients Related To Various Sociopolitical, Technical and Scientific Changes." *International Journal of Social Psychiatry* 54 (2): 101–111. doi:10.1177/0020764007083875. [PubMed: 18488404]
- Valentino-DeVries Jennifer, Singer Natasha, Keller Michael H, and Krolik Aaron. 2018 "Your Apps Know Where You Were Last Night, and They're Not Keeping It Secret." *The New York Times*, 12 10 <https://www.nytimes.com/interactive/2018/12/10/business/location-data-privacy-apps.html>.

Wernicke Martina, Hoftler Corinna, Jordan Kirsten, Fromberger Peter, Dechent Peter, and Müller Jürgen L. 2017 "Neural Correlates of Subliminally Presented Visual Sexual Stimuli." *Consciousness and Cognition* 49 (March): 35–52. doi:10.1016/j.concog.2016.12.011. [PubMed: 28107727]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript