

Listen to Your (Tipsy) Inner Voice: AI Is Not Your Drinking Buddy

Tori R.A. Kricken

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LISTEN TO YOUR (TIPSY) INNER VOICE: AI IS NOT YOUR DRINKING BUDDY

TORI R.A. KRICKEN*

AI is everywhere, helping and protecting society, right? In a mere twelve seconds, AI can use a person’s literal voice, regardless of the words spoken, to detect alcohol intoxication and save lives risked by intoxicated behaviors. Recent advances in artificial intelligence have reached a point where this technology not only exists, but also is inexpensive, instantaneous, easily accessible, increasingly accurate, and potentially undetectable. However, this voice analysis can also incriminate subjects and potentially reveal deeply personal information, all while bypassing typical constitutional protections. Such technology should be questioned lest society substitute for human judgment encoded procedures that obliterate privacy and misjudge character—often discriminately so for traditionally underrepresented populations. The necessary companion to “big data” breakthroughs of voice analysis is a thoughtful assessment of how to adapt individual rights in light of these advancements. From First Amendment freedoms through Fourteenth Amendment due process and equal protection, audio-based deep-learning algorithms used to identify alcohol inebriation present constitutional challenges that must be addressed. This Article does just that.

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INTRODUCTION

ChatGPT can provide recipes for really good alcoholic mixed drinks—and even create new ones. In a more profound effort to make life easier, better, and more efficient, ChatGPT also takes exams for students, writes reports for employees, analyzes international markets, plans vacations for families, and creates art and music.¹ But, this artificial intelligence-based chatbot cheats; it demonstrates bias; it tells lies. Apparently, deception is a “core challenge” for this technology.² Still, ChatGPT, like other emerging language-related technologies, such as corpus linguistics, has gained rising prominence in society and, intentionally or not, has led to increasing dependence by those same populations.³ Its presence is solidly established as

1. See, e.g., Kevin Roose, *The New ChatGPT Can ‘See’ and ‘Talk.’ Here’s What It’s Like.*, N.Y. TIMES (Sept. 27, 2023), <https://www.nytimes.com/2023/09/27/technology/new-chatgpt-can-see-hear.html>; Jack Doyle, *Breaking Down the ChatGPT Controversy*, MARYSUE (Feb. 22, 2023, 5:59 PM), <https://www.themarysue.com/breaking-down-the-chatgpt-controversy/>; see also CHATGPT, <https://chat.openai.com/> (last visited Dec. 14, 2023).

2. Amelia Thomson-DeVeaux & Curtis Yee, *ChatGPT Thinks Americans Are Excited About AI. Most Are Not.*, FIVETHIRTYEIGHT (Feb. 24, 2023, 6:00 AM), <https://fivethirtyeight.com/features/chatgpt-thinks-americans-are-excited-about-ai-most-are-not/>.

3. Muath Alser & Ethan Waisberg, *Concerns with the Usage of Chat GPT in Academia and Medicine: A Viewpoint*, AM. J. MED. OPEN 9 (2023); Karen Weise et al., *Inside the A.I. Arms Race that Changed Silicon Valley Forever*, N.Y. TIMES (Dec. 12, 2023), <https://www.nytimes.com/2023/12/05/technology/ai-chatgpt-google-meta.html>.

a mainstay in life. The marriage between humanity and machine has been consummated—for better or for worse.

Like most spouses, artificial intelligence is not alone in its awkward offerings of benefits and detriments. Now, in only twelve seconds, artificial intelligence can calculate alcohol intoxication based on just a short recording of a person's voice.⁴ The development of audio-based deep-learning algorithms to identify alcohol inebriation ("ADLAIA") permit scientists to detect levels of intoxication using only a twelve-second voice sample.⁵ Building off concepts such as language translation and automatic speech recognition, artificial intelligence provides a fast, consistent, and affordable method of identifying intoxicated individuals.⁶ In fact, ADLAIA already outperforms human abilities in classifying the inebriation status of individuals based on speech, especially with similar time constraints. ADLAIA's creators have suggested that the technology eventually "be integrated into mobile applications and used as a preliminary tool for identifying alcohol-inebriated persons."⁷ This artificial intelligence-based advancement undoubtedly will save lives; it will save billions of dollars; it will promote the health and welfare of society.⁸ In a merciless quest to improve our lives, artificial intelligence again weaves its robotic tentacles into every aspect of human existence. But, at what cost?

Like its predecessors in technological advancement, such as DNA testing and fingerprint analysis,⁹ artificial intelligence is not without fault or consequence. The potential presence of ADLAIA on mobile phones, on law enforcement recording devices, and in public locations presents significant constitutional implications. These uses are particularly concerning because ADLAIA could be combined with other voice analysis technology to reveal far more than inebriation. One's voice can reveal sensitive personal information about emotions, identity, health, and more. This Article draws on the established literature addressing the nuances of law and technology as a springboard to introduce the novel interplay of artificial intelligence and human rights on voice analysis technology.

4. A.A. Bonela et al., *Audio-Based Deep Learning Algorithm to Identify Alcohol Inebriation (ADLAIA)*, 109 ALCOHOL 49, 49 (2022).

5. *Id.*

6. *Id.*

7. *Id.* at 53.

8. *Id.* at 49.

9. See Eric E. Wright, *DNA Evidence: Where We've Been, Where We Are, and Where We Are Going*, 10 ME. BAR J. 206, 207 (1995) (addressing flaws with DNA evidence); Keith A. Findley, *The Absence or Misuse of Statistics in Forensic Science as a Contributor to Wrongful Convictions: From Pattern Matching to Medical Opinions About Child Abuse*, 125 DICK. L. REV. 615, 619 (2021) (discussing criticisms of fingerprint analysis).

The conversation begins with an introduction to voice-recognition technology and ADLAIA in particular¹⁰ before addressing impacts of audio-based deep-learning algorithms on Fourth Amendment search and seizure protections,¹¹ including ADLAIA's potential impact on reasonable suspicion, probable cause, and the presumption of innocence. The Article then addresses principles of the Fifth Amendment right against self-incrimination and how voice analysis may broaden the historical stance that one's literal voice is not protected.¹² From a confession standpoint, the use of such subtle technology triggers voluntariness concerns as well. Next, this Article delves into trial-related issues, such as the Fourteenth Amendment due process right to have access to the proprietary original source data utilized in the creation of deep-learning algorithms.¹³ Beyond the context of the trial, this Article addresses potential implications of Fourteenth Amendment equal protection applications, including the disparate impact of errors in the technology.¹⁴ The presence of such errors begs the question of the relevance and reliability of artificial intelligence, as it relates to admissibility in court and the weight given by jurors and law enforcement. Further, this Article discusses ADLAIA-related concerns with the Confrontation Clause given the lack of ability to "cross-examine" the algorithm.¹⁵ Finally, and most broadly, this Article considers unintended negative consequences on the right to privacy¹⁶ and First Amendment freedom of speech and freedom of assembly.¹⁷ Any one of these areas creates cause for concern; all deserve additional detailed attention. The Article concludes by considering how the law should respond to these challenges.¹⁸

AI now provides a mechanism permitting quick, easily accessible, and noninvasive detection of alcohol inebriation, even prior to risky or suspect behavior. The tradeoff for this benefit, however, is the potential relinquishment of individual rights and the risk of criminal conviction. The development of artificial intelligence surveillance devices raises the specter of governmental overshadowing of constitutional rights and of the scrutiny of one's literal voice on an unknowingly intimate level, all in the name of the public good. Governmental protections and individual rights sometimes make questionable bedfellows and, with the use of ADLAIA, artificial intelligence certainly is not your drinking buddy.

10. *See infra* Part I.

11. *See infra* Section II.A.

12. *See infra* Section II.B.

13. *See infra* Section II.C.

14. *See infra* Section II.D.

15. *See infra* Section II.E.

16. *See infra* Section II.F.

17. *See infra* Section II.G.

18. *See infra* Part III.

I. A PRIMER ON VOICE RECOGNITION AND VOICE-RELATED ARTIFICIAL INTELLIGENCE

A. *The Past and Present of Voice-Related Artificial Intelligence*

Utilizing the human body as a tool in criminal convictions is not new.¹⁹ Of common usage, past and present, is the implementation of eye-witness testimony of observations of another's likeness. Visual identification, in particular, spans not only eyewitness testimony, but identification parades, photos line-ups, and image comparison.²⁰ Historically, in addressing admissibility and weight of such evidence in the auditory context, courts focused on "the quantity and quality of material available to the witness, the distinctiveness of the voice in question, the level of the listener's familiarity, and whether voices were compared under similar conditions."²¹ More recently, experts in voice recognition entered the legal scene by using voice recordings and comparison evidence to identify speaker voice as attributable to one particular individual.²² Again, courts were concerned about the reliability of identification for a voice with which one was not previously familiar.²³

With technological advances, scientists, scholars, and jurists sought to eliminate concerns regarding the fallibility of human memory and subjective human comparison through the application of science to voice recognition, as has similarly been done with respect to facial recognition.²⁴ First attempts were less than successful; early efforts to identify a "voiceprint," unique to one particular individual failed.²⁵ Here, a story is apropos: In 1962, the term "voiceprint identification" was first introduced to refer to speech spectrogram representation.²⁶ The voiceprint was sold as "permanent and unique as a

19. *Holt v. United States*, 218 U.S. 245, 252–53 (1910) (condoning use of a defendant's "body as evidence when it may be material").

20. See Gary Edmond et al., *Unsound Law: Issues with ('Expert') Voice Comparison Evidence*, 35 MELBOURNE U. L. REV. 52, 54 (2011); J.P. Ludington, *Identification of Accused by His Voice*, 70 A.L.R.2d 995 (1960).

21. Edmond et al., *supra* note 20, at 56; see Cindy E. Laub, Lindsey E. Wylie & Brian H. Bornstein, *Can the Courts Tell an Ear from an Eye? Legal Approaches to Voice Identification Evidence*, 37 LAW & PSYCH. REV. 119 (2013).

22. Edmond et al., *supra* note 20, at 55–56; Lawrence M. Solan & Peter M. Tiersma, *Hearing Voices: Speaker Identification in Court*, 54 HASTINGS L.J. 373, 412 (2003).

23. Edmond et al., *supra* note 20, at 56; Solan & Tiersma, *supra* note 22, at 412.

24. KELSEY Y. SANTAMARIA, CONG. RSCH. SERV., R46541, FACIAL RECOGNITION TECHNOLOGY AND LAW ENFORCEMENT: SELECT CONSTITUTIONAL CONSIDERATIONS 4–5 (2020).

25. Moez Ajili, *Reliability of Voice Comparison for Forensic Applications* 37–38 (2017) (Ph.D. dissertation, Université d'Avignon), <https://theses.hal.science/tel-01774394/document>; see also Brian R. Clifford, *Voice Identification by Human Listeners: On Earwitness Reliability*, 4 LAW & HUM. BEHAV. 373, 380 (1980).

26. Ajili, *supra* note 25, at 43.

fingerprint,” useful “for speaker comparison purposes with a high degree of certainty.”²⁷ However, the science was faulty. By 1970, scientists refuted the permanency and uniqueness of the voiceprint, demonstrating that “speech spectrograms depend[] only partially and indirectly on the anatomical structure of the vocal tract.”²⁸ Instead, the “voiceprint” was only a visual depiction of articulatory movements, of which there was no proof that it could be traced to the individual speaker.²⁹ And yet, use of the voiceprint as a means of identification persists, cited in reference books and used by some experts, despite the fact that speech spectrograms have now been soundly scientifically disproven.³⁰

Currently, much-improved voice recognition models are employed routinely by law enforcement and intelligence agencies, as well as private industry.³¹ Of course, this evidence necessarily involves scientific and technical analysis, almost always by those unfamiliar with the voices and speakers. These analyses depend upon the uniqueness of the human voice, yet the science is significantly more complicated.³² A loose comparison of the process to that of voiceprints is helpful to an understanding of the intricacies of the process:

The plasticity of the speech organs and language means that no two utterances by the same person will ever be identical, or necessarily distinct from the utterances made by another individual. Thus, any comparison between two speech samples can only be probabilistic, rather than categorical; that is, it can indicate that the source of the utterances is *likely* the same or *likely* different, but not that the source *is* the same or *is* different. In order for a valid and reliable voice comparison of two utterances to be made, it is first necessary

27. *Id.*

28. *Id.*

29. *Id.*

30. *Id.*

31. Dominic Watt et al., *Who Owns Your Voice? Linguistic and Legal Perspectives on the Relationship Between Vocal Distinctiveness and the Rights of the Individual Speaker*, INT’L J. SPEECH, LANGUAGE & L. 137, 144–45 (2020).

32. See *id.* at 145; Hideki Kasuya & Hajime Yoshida, *Age-Related Changes in the Human Voice*, in AGING VOICE 27 (Kiyoshi Makiyama & Shigeru Hiran eds., 2017); Richard Rhodes, *Aging Effects on Voice Features Used in Forensic Speaker Comparison*, 24 INT’L J. SPEECH, LANGUAGE & L. 177 (2017); Lisa Roberts, *Acoustic Effects of Authentic and Acted Distress on Fundamental Frequency and Vowel Quality*, in 17 PROC. INT’L CONG. OF PHONETIC SCI. 1694 (2011); Kara M. Smith & David N. Caplan, *Communication Impairment in Parkinson’s Disease: Impact of Motor and Cognitive Symptoms on Speech and Language*, 185 BRAIN & LANGUAGE 38 (2018); Rupert Jones, *Voice Recognition: Is It Really as Secure as It Sounds?*, GUARDIAN (Sept. 22, 2018), <https://www.theguardian.com/money/2018/sep/22/voice-recognition-is-it-really-as-secure-as-it-sounds>; Carolyn McGettigan & Nadine Lavan, *Human Voices Are Unique – But Our Study Shows We’re Not That Good at Recognising Them*, CONVERSATION (June 16, 2017), <https://theconversation.com/human-voices-are-unique-but-our-study-shows-were-not-that-good-at-recognising-them-79520>.

to identify and measure the features present in the sample that are likely to be useful for discriminating between the origins of the utterances. Secondly, it is necessary to calculate the likelihood that two voices will share a certain proportion of these characteristics, distinctive or otherwise, by chance alone.³³

Further, “[t]hese systems compare digital voice samples in a way that does not resemble human speech perception very closely.”³⁴ Rather, similar to facial recognition techniques, voice recognition technology (implemented using proprietary methodology), employs algorithms to interpret certain voice features.³⁵ By analogy, here’s how it works: During the programming and training process, algorithms learn to focus on features that most reliably and consistently match one image (voice or face) to a paired image.³⁶ The ideal result is the algorithm’s ability to recognize a given face or voice.

The rest, as they say, is history. The use of algorithms in artificial intelligence permits the implemented technology to “learn” how to compare, contrast, and recognize voices.³⁷ Broadly speaking, algorithms transform input data into a desired output, allowing it to solve a given task. In the context of face or voice recognition, biometric technology uses these automated, encoded processes to identify an individual through unique physical characteristics, such as fingerprints, speech patterns, or facial features.³⁸ Of course, as later discussed, just as with facial recognition technology, the interpretation of voice is only as good as its algorithms.³⁹ In general, however, the use of artificial intelligence in speech recognition applications (what is being said) as well as speaker recognition (who is saying it) has been considered successful and ever-improving.⁴⁰

In its prior uses, however, voice evidence served only as speech/voice *recognition* evidence, nothing more.⁴¹ But, voice conveys much more than literal words. The formation of human speech involves a myriad of factors:

33. Edmond et al., *supra* note 20, at 85 (footnotes omitted).

34. Watt et al., *supra* note 31, at 143.

35. See SANTAMARIA, *supra* note 24, at 4–5.

36. See *id.* at 4; Ajili, *supra* note 25, at 37.

37. See SANTAMARIA, *supra* note 24, at 4–5.

38. JOY BUOLAMWINI ET AL., FACIAL RECOGNITION TECHNOLOGIES: A PRIMER 8 (2020).

39. SANTAMARIA, *supra* note 24, at 4–5.

40. See Watt, *supra* note 31, at 144–45; see also Kyle Wiggers, *Resemble AI Launches Voice Synthesis Platform and Deepfake Detection Tool*, VENTUREBEAT (Dec. 17, 2019), <https://venturebeat.com/2019/12/17/resemble-ai-launches-voice-synthesis-platform-and-deepfake-detection-tool/> (describing programs including Lyrebird, Deep Voice, and Resemble, and noting that “only a few minutes—and in the case of state-of-the-art models, a few seconds—are required to imitate a subject’s prosody and intonation with precision”).

41. Edmond et al., *supra* note 20, at 61.

individual traits (anatomical⁴² and psychological) and emotional states, all of which determine expression and perception.⁴³ Vocal features like “pitch, loudness, and the presence and duration of speech pauses . . . can reveal both state- and trait-level information about a speaker.”⁴⁴ For example, generally, women speak with a higher frequency than men; taller individuals speak in lower and more closely spaced frequencies; contemplation is associated with slower speech with longer pauses, while anger is associated with louder speech.⁴⁵ The list goes on. Suffice to say, both speech and non-verbal sounds convey much about the speaker beyond mere words.⁴⁶

Enter, once again, technological advance. Science now claims to be capable of using voice samples to detect the speaker’s emotions, physical condition, and much more.⁴⁷

The potential—and the peril—of voice analytics is that it goes beyond what a human listener can catch; our voice gives away far more insights than we realize Voice data conveys clues to “a speaker’s biometric identity, personality, physical traits, geographical origin, emotions, level of intoxication and sleepiness, age, gender, and health condition,” along with socioeconomic status in certain speech patterns.⁴⁸

42. Christian Hildebrand et al., *Voice Analytics in Business Research: Conceptual Foundations, Acoustic Feature Extraction, and Applications*, 121 J. BUS. RSCH. 364, 365 (2020). Indeed, it is imperative to recognize the impact of anatomical traits on speech formation: “The specific way that you say ‘Hello’ depends upon the shape and length of your anatomical articulators such as your teeth, tongue, and the size of your oral and nasal cavity.” *Id.* (emphasis omitted).

43. *Id.*

44. *Id.* at 364.

45. *Id.* at 365.

46. Marco Almada & Julianio Maranhao, *Voice-Based Diagnosis of COVID-19: Ethical and Legal Challenges*, 11 INT’L DATA PRIV. L. 63, 63 (2021).

47. Peggy Valcke, Damian Clifford & Vilté Kristina Dessers, *Constitutional Challenges in the Emotional AI Era*, in CONSTITUTIONAL CHALLENGES IN THE ALGORITHMIC SOCIETY 57, 58 (Hans-W. Micklitz et al. eds., 2022); see Angela Chen, *Why Companies Want to Mine the Secrets in Your Voice*, VERGE (Mar. 14, 2019, 12:48 PM), <https://www.theverge.com/2019/3/14/18264458> (reporting a large European bank used a voice start-up to categorize its debtors into risk pools); Matt Reynolds, *Health Insurer Calls Analysed for Signs of Disease in Your Voice*, NEWSIDENTIST (Feb. 6, 2017), <https://www.newscientist.com/article/2120426> (describing algorithms identifying early signs of Alzheimer’s disease from phone calls to a health insurer); *Can Voice Analytics Help HR Find Better Candidates?*, SPEECH TECH. (Oct. 31, 2018), <https://www.speechtechmag.com/Articles/ReadArticle.aspx?ArticleID=128280> (noting a company that offers HR departments an algorithm that uses speech parameters to determine candidate compatibility); see also Joan Palmiter Bajorek, *Voice Recognition Still Has Significant Race and Gender Biases*, HARV. BUS. REV. (May 10, 2019), <https://hbr.org/2019/05/voice-recognition-still-has-significant-race-and-gender-biases> (discussing bias in voice recognition technology).

48. Emma Ritter, Note, *Your Voice Gave You Away: The Privacy Risks of Voice-Inferred Information*, 71 DUKE L.J. 735, 751 (2021) (quoting Jacob Leon Kröger et al., *Privacy Implications of Voice and Speech Analysis—Information Disclosure by Inference*, in PRIVACY AND DATA MANAGEMENT 242, 242 (Kai Rannenberg ed., 2020)).

However, the expanded uses of such technology, from mere speech recognition to the broader realms of speech connotation, emotional state, and physical condition “may open the door to inaccurate and discriminatory personalization.”⁴⁹ As mentioned, “the accuracy of [voice-based analysis] is vulnerable to various factors, including the condition in which the voice sample is recorded, characteristics of the voice in contention (such as pronunciation), the quality of the device used for recording the voice, skills of the examiner, and so on.”⁵⁰ Unlike DNA and fingerprints, the voice is “far from constant and will change over the time.”⁵¹ It changes based on “health and emotional state”; it can be “altered voluntarily.”⁵² “It is a phonetic truism that no one can say the same word in exactly the same way two times.”⁵³ The variability of the voice itself suggests an arena rife with the risk of harm.⁵⁴

Indeed, those familiar with “always-listening” devices, such as Alexa, Siri, and Google Home, also are aware of the frequency with which those devices make word mistakes.⁵⁵ “One study documents how popular Netflix

49. *Id.* at 740.

50. Aditi Behura & Ashray Behura, *Voice Recordings and the Right Against Self-Incrimination*, 8 GUJARAT NAT’L L. U. L. REV. 392, 400 (2021); see Poorna Banerjee Dasgupta, *Detection and Analysis of Human Emotions Through Voice and Speech Pattern Processing*, 52 INT’L J. COMPUT. TRENDS & TECH., 1, 1–3 (2017) (proposing an algorithmic approach for detection and analysis of human emotions with the help of voice and speech processing); Joshua J. Guyer, Leandre R. Fabrigar & Thomas I. Vaughan-Johnston, *Speech Rate, Intonation, and Pitch: Investigating the Bias and Cue Effects of Vocal Confidence on Persuasion*, 45 PERSONALITY & SOC. PSYCH. BULL. 389 (2019) (investigating the effects and psychological mechanisms of vocal qualities on persuasion); Xiaoming Jiang & Marc D. Pell, *The Sound of Confidence and Doubt*, 88 SPEECH COMM’N, 106 (2017) (detailing studies that demonstrate that changes in vocal properties influence global perceptions of speaker confidence); Tom Johnstone & Klaus R. Scherer, *The Effects of Emotions on Voice Quality*, 19 PROC. INT’L CONG. PHONETIC SCI. 2029 (1999) (addressing relationships between acoustic speech parameters and speaker attitudes and emotions); Rosa G. Kamiloglu et al., *Good Vibrations: A Review of Vocal Expressions of Positive Emotions*, 27 PSYCHONOMIC BULL. & REV. 237 (2020) (reviewing characteristics of vocal expressions of different positive emotions and limitations thereon); Casey A. Klofstad et al., *Sounds Like a Winner: Voice Pitch Influences Perception of Leadership Capacity in Both Men and Women*, 279 PROC. ROYAL SOC’Y BIOLOGICAL SCI. 2698 (2012) (studying how humans respond to information encoded in vocal signals, specifically how voice pitch impacts leadership); Klaus R. Scherer, *Vocal Communication of Emotion: A Review of Research Paradigms*, 40 SPEECH COMM’N 227 (2003) (detailing research on how emotion alters voice and speech).

51. Ajili, *supra* note 25, at 26.

52. *Id.*

53. *Id.* at 64.

54. See Watt et al., *supra* note 31, at 141 (describing potential harms from skilled impersonators of voices); Valcke et al., *supra* note 47, at 66 (discussing legal and ethical challenges posed by the emergence of emotional artificial intelligence and its manipulative capabilities); Francis Nolan, *Degrees of Freedom in Speech Production: An Argument for Native Speakers in LADO*, 19 INT’L J. SPEECH, LANGUAGE & L. 263 (2012) (discussing “degrees of freedom” of speech organs that are subject to manipulation and permit flexibility in speech).

55. Lindsey Barrett & Ilaria Liccardi, *Accidental Wiretaps: The Implications of False Positives by Always-Listening Devices for Privacy Law & Policy*, 74 OKLA. L. REV. 79, 90–91 (2022).

shows set off various smart speakers, while other researchers have documented Amazon's Alexa alerting to 'unacceptable' and 'election,' Google Home alerting to 'Ok, cool,' Siri to 'a city,' and Cortana to 'Montana,' among other confusions."⁵⁶ Applying those concepts to ADLAIA-like technologies, one questions their admissibility absent sufficient testing for accuracy, particularly where "few outside of law enforcement and algorithm proprietors are able to access them."⁵⁷

Of course, the quality of the recording matters, too. If the quality of the speech is poor (e.g., if the speech is heard through a telephone, whispered, or part of a low-quality recording); if the exposure time or speech duration is short; if there is background noise or distraction (such as would be expected in a public location), accuracy suffers.⁵⁸ Further, recordings may be created in different situations and, particularly in a law enforcement interaction, speakers "are not necessarily cooperative and may disguise their voices, with consequences on performance."⁵⁹

Of greatest concern are the studies that demonstrate that such technology is least accurate in groups that tend to be underrepresented and/or disadvantaged. For example, the North American Chapter of the Association for Computational Linguistics has indicated "that Google's speech recognition is 13% more accurate for men than it is for women."⁶⁰ Beyond gender, race and dialect also alter accuracy: "For example, Indian English has a 78% accuracy rate and Scottish English has a 53% accuracy rate."⁶¹ Thus, quite inadvertently, one's literal voice necessarily includes meta-information about "social status, personality, emotions, geographical location, group affiliations, gender, and intelligence."⁶² Just as the human ear may misjudge based on voice, so, too, can artificial intelligence.⁶³

56. *Id.* (footnotes omitted); see Daniel J. Dubois et al., *When Speakers Are All Ears: Characterizing Misactivations of IoT Smart Speakers*, 4 PROC. ON PRIV. ENHANCING TECHS. 255, 255 (2020) ("After playing two rounds of 134 hours of content from 12 TV shows near popular smart speakers in both the US and in the UK, we observed cases of 0.95 misactivations per hour, or 1.43 times for every 10,000 words spoken, with some devices having 10% of their misactivation durations lasting at least 10 seconds."); Lea Schönherr et al., "Unacceptable, Where Is My Privacy?" Exploring Accidental Triggers of Smart Speakers (2019) (unpublished manuscript), <https://unacceptable-privacy.github.io/>.

57. Namrata Kakade, Note, *Sloshing Through the Factbound Morass of Reasonableness: Predictive Algorithms, Racialized Policing, and Fourth Amendment Use of Force*, 88 GEO. WASH. L. REV. 788, 808 (2020).

58. Edmond et al., *supra* note 20, at 88–89; Ajili, *supra* note 25, at 19–20.

59. Ajili, *supra* note 25, at 19–20.

60. See Bajorek, *supra* note 47 ("Google is regularly the highest performer—as compared to Bing, AT&T, WIT, and IBM Watson systems.").

61. *Id.*

62. Andrew E. Taslitz, *Confessing in the Human Voice: A Defense of the Privilege Against Self-Incrimination*, 7 CARDOZO PUB. L., POL'Y & ETHICS J. 121, 162 (2008).

63. See *id.* at 162–63.

“Each of these variables, in addition to the known variability of speech in general, makes reliable discrimination of speakers a complicated and daunting task.”⁶⁴ Analytical or algorithmic bias related to racial or ethnic background, for example, may not be recognized as such by a law enforcement officer when integrated into an automated computer program that is deemed independent and neutral.⁶⁵ Blind reliance on these programs inadvertently may result in standardization of these biases, reducing the likelihood that accuracy will be questioned.⁶⁶ If the algorithms are inaccurate, should they be admissible in court under notions of reasonable suspicion, probable cause, or beyond a reasonable doubt?⁶⁷ The results can be significant. For example, George Zimmerman, was charged with second-degree murder in the shooting to Trayvon Martin on February 26, 2012.⁶⁸ Zimmerman asserted that he was acting in self-defense, and one of the issues before the trial court involved a telephone call made to a 911 operator in which a scream could be heard shortly before the gunshot that killed Martin.⁶⁹ Prosecutors and defense attorneys debated whether the scream belonged to Martin, seconds before his death, or to Zimmerman during the confrontation, supporting his self-defense theory: “[T]he legal battle is over the validity of the science—particularly computer voice-matching—used by the different experts in making their appraisals of what is going on in the recording. The defense argues that the prosecution’s experts are using untested science and shouldn’t be allowed to testify at all.”⁷⁰ Ultimately, the Court ruled that expert testimony as to voice analysis would be disallowed due to unreliability, though the jury would be permitted to hear the recording.⁷¹

64. Ajili, *supra* note 25, at 19 (emphasis omitted) (quoting Campbell et. al., *Forensic Speaker Recognition*, IEEE SIGNAL PROCESSING MAG., Mar. 2009, at 95).

65. COMM. OF EXPERTS ON INTERNET INTERMEDIARIES, COUNCIL OF EUR., STUDY ON THE HUMAN RIGHTS DIMENSIONS OF AUTOMATED DATA PROCESSING TECHNIQUES (IN PARTICULAR ALGORITHMS) AND POSSIBLE REGULATORY IMPLICATION 11 (2017) [hereinafter HUMAN RIGHTS OF AUTOMATED DATA PROCESSING TECHNIQUES].

66. *Id.*

67. Kakade, *supra* note 57, at 808–09.

68. Mark Memmott, *That’s ‘My Son Screaming’ on 911 Call, Trayvon’s Mother Says*, NPR (July 5, 2013, 10:36 AM), <https://www.npr.org/sections/thetwo-way/2013/07/05/199027525/thats-my-son-screaming-on-911-call-trayvons-mother-says>.

69. *Id.*

70. Michael Muskal, *Voice Analysis of 911 Call Is at Issue in George Zimmerman Case*, L.A. TIMES (June 6, 2013, 12:00 AM), <https://www.latimes.com/nation/la-xpm-2013-jun-06-la-na-nn-george-zimmerman-911-call-20130606-story.html>.

71. *Zimmerman Trial Judge: Prosecution Audio Experts Cannot Testify*, GUARDIAN (June 22, 2013), <https://www.theguardian.com/world/2013/jun/22/george-zimmerman-trayvon-martin-phone-calls>; Yamiche Alcindor, *Zimmerman Judge: Jury Won’t Hear State Voice Experts*, USA TODAY (June 22, 2013), <https://www.usatoday.com/story/news/nation/2013/06/22/voice-expert-zimmerman-trayvon/2448713/>; see also Ajili, *supra* note 25, at 47–48.

As is evident from the above-mentioned Zimmerman case, courts are gatekeepers, charged with the duty of ensuring that “any and all scientific testimony or evidence admitted is not only relevant, but reliable.”⁷² The claim that forensic scientists are able to link a hair, a fingerprint, or other forensic items to a unique source contributes to the necessity that such evidence be subjected to a heightened threshold for admission of evidence.⁷³ This is particularly true where jurors may be inclined to give unfettered, blind acceptance to scientific evidence, “[g]iven the assumption of objectivity and accuracy that often attaches to algorithmic calculations over human perception.”⁷⁴ Algorithmic analysis is not bias-free, nor is it foolproof. Courts, then, must continue to grapple with the degree of certainty required in assessing its admissibility and the weight afforded such evidence.⁷⁵ The latest artificial intelligence aimed at voice analysis hints at even more.

B. The Future of Voice-Related Artificial Intelligence: Using Voice Analytics to Detect Intoxication

One’s speech is undeniably altered by physical and mental states that affect cognitive and physical performance.⁷⁶ Generally, alcohol has a medium-to-large negative effect on cognitive and motor function, leading to detectable changes in behavior and impaired information processing, including speech/communication, vision/tracking, and other motor tasks.⁷⁷ Intoxication further has physiological effects including “dehydration, changes in the elasticity of muscles, and reduced control over the vocal apparatus, leading to changes in speech parameters like pitch, jitter, shimmer, speech rate, speech energy, nasality, and clarity of pronunciation. Slurred speech is regarded as a hallmark effect of excessive alcohol consumption.”⁷⁸

While the average listener of inebriated speech is somewhat able to perceive a general state of intoxication, perception of the specific level of intoxication is all but impossible, including for trained listeners.⁷⁹ However,

72. *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 589 (1993).

73. See Ajili, *supra* note 25, at 30.

74. Kakade, *supra* note 57, at 809.

75. *Id.* (discussing issues with accuracy in predicative policing algorithms).

76. Jacob Leon Kröger, Otto Hans-Martin Lutz & Philip Raschke, *Privacy Implications of Voice and Speech Analysis – Information Disclosure by Inference*, in *PRIVACY AND IDENTITY MANAGEMENT: DATA FOR BETTER LIVING: AI AND PRIVACY* 242, 247 (Michael Friedewald et al. eds., 2020).

77. See generally *Alcohol and the Brain: An Overview*, NAT’L INST. ON ALCOHOL ABUSE & ALCOHOLISM, <https://www.niaaa.nih.gov/publications/alcohol-and-brain-overview> (last visited Dec. 11, 2023).

78. Kröger et al., *supra* note 76, at 247.

79. Risha Mal et al., *Intoxicated Speech Detection Using MFCC Feature Extraction and Vector Quantization*, 7 INT’L J. OF ELEC. & ELEC. ENG’G 269, 269–70 (2014); see also Gary Edmond et al., ‘Mere Guesswork’: Cross-Lingual Voice Comparisons and the Jury, 33 SYDNEY L. REV. 395,

with the creation of ADLAIA, artificial intelligence is capable of almost-instantly identifying alcohol inebriation at a BAC of 0.05% or higher, with an accuracy of at least 67.67%.⁸⁰ Although not ideal, these results are better than the average human discrimination rate of 63.1%.⁸¹ More specifically, using the German Alcohol Language Corpus Dataset, which contains audio recordings of 162 speakers who recorded when sober and when they had consumed alcohol, researchers developed and applied deep-learning algorithms to create the ability to identify inebriation.⁸² While original speech ranged from reading single numeric digits to full conversations, for purposes of the study, the clips were trimmed in length to twelve seconds.⁸³ At a BAC of 0.08%, the accuracy reached 68.97%.⁸⁴ Again, it is noteworthy that the accuracy rate of ADLAIA achieves instant results better than that of human detection.⁸⁵ And, ADLAIA's abilities and accuracy continue to improve as alcohol intoxication increases.⁸⁶

Of course, researchers recognized certain limitations with the study based on the dataset, imbalanced class distribution, and other influencing factors.⁸⁷ Additionally, in the context of ADLAIA, concerns surrounding inaccuracy and bias may be particularly significant given that humans respond to alcohol in various and unpredictable ways: "The effect of alcohol on psychomotor performance and perceived impairment in chronic heavy drinkers is a complex subject, poorly studied, and not yet fully understood."⁸⁸ The physiologic tolerance associated with alcohol exposure actually may result in a process that "rewards" those who exhibit a diminished response to given alcohol levels.⁸⁹ The effects of alcohol on speech also vary widely among the general population:

While there is a general dose-dependent effect of alcohol in humans with regard to diminished cognitive and psychomotor skills, prior experience with alcohol, duration and degree of

411–12 (2011) (discussing error rates in voice identification and observing that accuracy is impacted by the speaker's intoxication).

80. Bonela et al., *supra* note 4, at 52.

81. *Id.* at 52–54.

82. *Id.* at 50. The actual level of inebriation was measured by breath alcohol and blood samples taken immediately before the speech recording. *Id.* The age of speakers ranged from twenty-one to seventy-five (average of thirty-one) and 47.7% of speakers were female. *Id.*

83. *Id.* at 50.

84. *Id.* at 53.

85. Kröger et al., *supra* note 76, at 247.

86. Bonela et al., *supra* note 4, at 53.

87. *Id.*

88. James R. Roberts & Denis Dollard, *Alcohol Levels Do Not Accurately Predict Physical or Mental Impairment in Ethanol-Tolerant Subjects: Relevance to Emergency Medicine and Dram Shop Laws*, 6 J. MED. TOXICOLOGY 438, 440 (2010).

89. *Id.*

consumption, and individual tolerance render impossible a strict assignment of impairment or degradation of physical, mental, and cognitive parameters to any given alcohol level.⁹⁰

As a result, even those with expertise in the field often are unable to recognize when others are intoxicated, and certainly are unable to assess their degree of inebriation.⁹¹ Nevertheless, scientists suggest that ADLAIA ultimately could be utilized as a preliminary tool for identifying intoxicated individuals in environments such as bars, night clubs, emergency rooms, and sports stadiums, “in which an instant identification of inebriation is useful Due to the ubiquitous nature of smartphones, this algorithm can be used by *everyone everywhere*.”⁹²

Certainly, acute alcohol intoxication leads to various and significant public health hazards, and instant detection of intoxication would, no doubt, prove useful in identifying inebriated individuals and protecting public safety.⁹³ However, the “fast-growing use of algorithms in the fields of justice, policing, public welfare, and the like could end in biased and erroneous decisions, boosting inequality, discrimination, unfair consequences, and undermining constitutional rights, such as privacy, freedom of expression, and equality.”⁹⁴ The dilemma, then, is whether and to what extent should public safety come at a cost of limitations on individual rights.⁹⁵

II. IMPLICATIONS OF ADLAIA ON INDIVIDUAL RIGHTS

The use of artificial intelligence to identify intoxication in the human voice, instantly and based on only a twelve-second voice clip, has significant implications in both the public and private spheres.⁹⁶ From potential effects on constitutional rights to negative consequences in the private arena, these issues are worth more than a twelve-second look. Recognizing the challenges inherent in this technology, this next Part considers potential consequences of ADLAIA on Fourth Amendment rights against unreasonable searches and seizures, Fifth Amendment protection against self-incrimination, Fourteenth

90. *Id.*

91. *Id.* at 440–41.

92. Bonela et al., *supra* note 4, at 53 (emphasis added).

93. See generally *Alcohol's Effect on Health*, NAT'L INST. ON ALCOHOL ABUSE & ALCOHOLISM, <https://www.niaaa.nih.gov/alcohols-effects-health> (last visited Dec. 11, 2023).

94. Andrea Simoncini & Erik Longo, *Fundamental Rights and the Rule of Law in the Algorithmic Society*, in CONSTITUTIONAL CHALLENGES IN THE ALGORITHMIC SOCIETY, *supra* note 47, at 27, 34.

95. Aleš Završnik, *Criminal Justice, Artificial Intelligence Systems, and Human Rights*, 20 ERA F. 567, 572 (2020).

96. Of note, this technology is not currently in use, by either public or private entities, to measure alcohol intoxication. However, this Article predicts the potential violations that could result from such future use.

Amendment due process and equal protection guarantees, the Sixth Amendment right to confront witnesses in criminal trials, privacy rights, and First Amendment free speech and free association protections.

A. Fourth Amendment: Search and Seizure

The Fourth Amendment to the United States Constitution provides: “The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated”⁹⁷ The Fourth Amendment shields against unreasonable government searches and seizures, protecting the rights of individual citizens from governmental intrusion into areas deemed private.

1. Broadening the Expectation of Privacy

The definition of a “search” under the Fourth Amendment “was crafted, appropriately enough, in a case where government officials employed technology to enhance their senses.”⁹⁸ In *Katz v. United States*,⁹⁹ the defendant was convicted of violating a federal statute by transmitting wagering information by telephone from Los Angeles to Miami and Boston. At trial, the prosecution presented evidence of the defendant’s end of a telephone conversation, which had been recorded by a device attached to the outside of a public telephone booth from which he placed the calls.¹⁰⁰ In reversing the conviction, the U.S. Supreme Court held, “[t]he Government’s activities in electronically listening to and recording the petitioner’s words violated the privacy upon which he justifiably relied while using the telephone booth and thus constituted a ‘search and seizure’ within the meaning of the Fourth Amendment.”¹⁰¹ Derived from *Katz*, the two-part “reasonable expectation of privacy” test holds that a Fourth Amendment search occurs when, first, a person has exhibited an actual (subjective) expectation of privacy and, second, the expectation is one that society recognizes as “reasonable.”¹⁰² Exceptions aside, the requirements of reasonableness generally are satisfied by obtaining a search warrant, supported by probable cause, prior to the search.¹⁰³

The human body has been deemed a constitutionally protected area, upon which the Fourth Amendment broadly prohibits government

97. U.S. CONST. amend. IV.

98. George M. Dery, *Lying Eyes: Constitutional Implications of New Thermal Imaging Lie Detection Technology*, 31 AM. J. CRIM. L. 217, 221 (2004).

99. 389 U.S. 347 (1967).

100. *Id.* at 348.

101. *Id.* at 353.

102. Dery, *supra* note 98, at 222 (citing *Katz*, 389 U.S. at 361).

103. *Id.*

intrusion.¹⁰⁴ However, in the public domain a person generally does not have a Fourth Amendment interest in activities or physical characteristics that are exposed to the public.¹⁰⁵ Thus, public observation of an individual, be it body, voice, or belongings, is not considered a “search” under the Fourth Amendment: “When people throw out their trash, cash checks at banks, or drop off film for development, they effectively cede any expectation of privacy in those items by publicizing them to third parties.”¹⁰⁶ This conclusion has held true even where the government has used technological tools to assist with its observations, as in the case of electronic tracking devices.¹⁰⁷

Where, then does the human voice lie? It certainly is part of the human body, but it also is commonly exposed to the public. Specifically, in cases where law enforcement has sought a suspect’s voice sample, Fourth Amendment challenges historically have failed on the grounds that a person’s speech is frequently made public.¹⁰⁸ Thus, the government can demand a “sample” for “matching” purposes. For example, in *United States v. Dionisio*,¹⁰⁹ twenty suspects were subpoenaed by a grand jury to provide voice samples to the local U.S. Attorney’s office. After a Fourth Amendment challenge by one suspect, the Supreme Court held that the required disclosure of a person’s voice does not implicate Fourth Amendment protections.¹¹⁰ The Court explained that the disclosure was not a search because “[n]o person can have a reasonable expectation that others will not know the sound of his

104. See SANTAMARIA, *supra* note 24, at 11.

105. *Id.* at 12 (citing *Katz*, 389 U.S. at 351); see also *United States v. Dionisio*, 410 U.S. 1, 14–15 (1973) (holding that a directive for a witness to give a voice exemplar did not constitute an infringement of the witness’s Fourth Amendment rights).

106. Douglas A. Fretty, *Face-Recognition Surveillance: A Moment of Truth for Fourteenth Amendment Rights in Public Places*, 16 VA. J.L. & TECH. 430, 439–40 (2011) (footnotes omitted) (collecting sources); see *California v. Greenwood*, 486 U.S. 35, 43–44 (1988) (no private property interest where garbage is accessible to public); *United States v. Miller*, 425 U.S. 435, 435 (1976) (no expectation of privacy where depositor’s disclosure of the checks was voluntary); *Wabun-Inini v. Sessions*, 900 F.2d 1234, 1239 (8th Cir. 1990) (customer’s handing the film to the developer waived his privacy rights, even if customer did not expect specific disclosure to FBI); see also Jim Harper, *Reforming Fourth Amendment Privacy Doctrine*, 57 AM. U. L. REV. 1381, 1402 (2008) (“[T]he government can compel a service provider to maintain records about a customer and then collect those records without implicating his or her Fourth Amendment rights.”); *United States v. Miller*, 425 U.S. 435, 443 (1976) (“[T]he Fourth Amendment does not prohibit the obtaining of information revealed to a third party . . . even if the information is revealed on the assumption that it will be used only for a limited purpose and the confidence placed in the third party will not be betrayed.”).

107. SANTAMARIA, *supra* note 24, at 13; see *United States v. Knotts*, 460 U.S. 276, 295 (1983).

108. Rinat Kitai-Sangero, *The Protection of Free Choice and the Right to Passivity: Applying the Privilege Against Self-Incrimination to Physical Examinations and Documents’ Submission*, 29 WM. & MARY BILL RTS. J. 271, 299 (2020).

109. 410 U.S. 1 (1973).

110. *Id.* at 14.

voice, any more than he can reasonably expect that his face will be a mystery to the world.”¹¹¹ Thus, because the voice was subjected to public exposure, its owner lost any reasonable expectation of privacy.¹¹²

Dionisio, however, was written in 1973, long before artificial intelligence could permit the public a glimpse into the private realms of a human’s thoughts, emotions, and physical state.¹¹³ Those rules may be outdated,¹¹⁴ and advancements in voice-based analysis made possible by ADLAIA call for a closer look into broadening the category of items for which an individual has a reasonable expectation of privacy. With ADLAIA, the use of voice is no longer being used merely to identify the speaker, something solidly public for anyone who steps outside his front door. Rather, voice is used as a method to gather information that is not publicly available and, indeed, information that is not even available through use of human sense or awareness. ADLAIA permits its user to gather voice-based evidence of intoxication, akin to an admission of guilt, through the analysis of a person’s voice in a manner that is inaccessible through ordinary public perception.¹¹⁵

As to this point, use of technologies such as audio-based detection of levels of intoxication, do more than simply identify a person’s voice or match it to another voice sample, for which there is a strong argument in favor of its public availability (and corresponding lack of Fourth Amendment protection). Instead, a permanent voice recording is analyzed—by means beyond the human senses or perception—and then utilized to gather potentially incriminating evidence against that individual with respect to their level of intoxication.¹¹⁶ For this, there is a compelling argument in favor of some expectation of privacy.

Indeed, the Supreme Court has suggested that different constitutional principles, including privacy concerns, may apply as science makes extended

111. *Dionisio*, 410 U.S. at 14; see also *United States v. Euge*, 444 U.S. 707, 713, (1980) (explaining that traditionally witnesses could be compelled to submit to “fingerprinting, photographing, or measurements, to write or speak for identification, to appear in court, to stand, to assume a stance, to walk, or to make a particular gesture” (quoting *Schmerber v. California*, 384 U.S. 757, 764 (1966))).

112. The Court also concluded that the requirement to appear before the grand jury to provide the voice exemplar did not rise to the level of being a “seizure.” *Dionisio*, 410 U.S. at 14. On ADLAIA and Fourth Amendment seizures, see *infra* Section II.B.2.

113. *United States v. Mara*, 410 U.S. 19, 21 (1973) (noting that “physical characteristics” are “constantly exposed to the public”).

114. Ryan G. Bishop, *The Walls Have Ears . . . and Eyes . . . and Noses: Home Smart Devices and the Fourth Amendment*, 61 ARIZ. L. REV. 667, 683 (2019) (“Given the rise of smart devices and the dearth of case law directly addressing them, courts will soon need to address the use of these devices in police investigations and determine the appropriate application of existing case law.”).

115. See *supra* Section I.B.

116. ADLAIA measures intoxication but it is conceivable that advances in this technology could measure other physical and mental states.

and comprehensive surveillance of a person's public activities easier.¹¹⁷ Where the government is able, through technologically advanced surveillance, to discover certain forms of personal information, an intrusion on that individual's reasonable expectation of privacy can occur.¹¹⁸ For example, *Carpenter v. United States*¹¹⁹ involved a scenario where the government acquired wireless carrier cell-site records that revealed an individual's location (based on cell phone location). The Supreme Court noted that the situation "[did] not fit neatly under existing precedents" and concluded that the Fourth Amendment was implicated by prolonged and sustained surveillance of public activities—in that case, the precise tracking of the suspect's location.¹²⁰ Although the Court relied heavily on the extended period of time during which the individual's movements were monitored, the Court also noted "[a] person does not surrender all Fourth Amendment protection by venturing into the public sphere. To the contrary, 'what [one] seeks to preserve as private, even in an area accessible to the public, may be constitutionally protected.'"¹²¹ The *Carpenter* Court was critical of the government's access to deeply personal information, including "familial, political, professional, religious, and sexual associations" made possible by developments in technology.¹²²

The use of audio-based learning algorithms on voice may disclose equivalent levels of personal information. A person's voice is more than mere words; it also reveals glimpses into the same historical information noted in *Carpenter*. Voice analysis now reveals "almost as much information about a speaker as the content itself,"¹²³ arguably more. It is not the public availability of words or the sound of the voice that run afoul of the Fourth Amendment

117. See *Carpenter v. United States*, 138 S. Ct. 2206, 2215 (2018); *United States v. Jones*, 565 U.S. 400 (2012); see also SANTAMARIA, *supra* note 24, at 13; Fretty, *supra* note 106, at 440 ("Regardless of ideology, scholars agree that advances in surveillance could soon winnow Fourth Amendment protection in public to a nub, if the reasonable expectation test continues to be literally applied."); Maclin Tracey, Katz, Kyllo, and Technology: *Virtual Fourth Amendment Protection in the Twenty-First Century*, 72 MISS. L.J. 51, 85–86 (2002) ("In a technologically advanced society, acceptance of Justice Rehnquist's rationale in *Knotts*—equating electronic surveillance with what police might theoretically accomplish with naked eye monitoring—means that the Fourth Amendment will protect very little.").

118. SANTAMARIA, *supra* note 24, at 13.

119. 138 S. Ct. 2206 (2018).

120. *Id.* at 2212, 2215.

121. *Id.* at 2217 (second alteration in original) (quoting *United States v. Katz*, 389 U.S. 347, 351–52 (1967)).

122. *Id.* (quoting *Jones v. United States*, 564 U.S. 400, 415 (2012) (Sotomayor, J., concurring)).

123. Abigail Fagan, *How Is Your Voice Perceived?*, PSYCH. TODAY (May 17, 2019), <https://www.psychologytoday.com/us/articles/201905/how-is-your-voice-perceived>; see Zachariah N.K. Marrero et al., *Evaluating Voice Samples as a Potential Source of Information About Personality*, 230 ACTA PSYCHOLOGICA, Oct. 2022, at 1.

but, rather, the private information that artificial intelligence unlocks.¹²⁴ Ironically, the *Carpenter* Court noted that a cellphone is “almost a ‘feature of human anatomy.’”¹²⁵ Certainly, then, it takes only a small logical leap to argue that the use of audio-based algorithms to analyze voice may provide a similar “intimate window into a person’s life,”¹²⁶ and that this intrusion deserves Fourth Amendment analysis.

By way of further comparison, consider the use of thermal imaging as a means of lie detection.¹²⁷ The automatic nervous system’s reaction to telling lies causes blood to rush to the eyes, a byproduct of which is heat around the eyes.¹²⁸ Thermal imaging can detect the heat pattern on an individual’s face, permitting others to draw inferences about the contents of the person’s mind, i.e., whether he is lying. In *Kyllo v. United States*,¹²⁹ the Supreme Court concluded that gathering thermal images inside a home to gain private information constituted a search under the Fourth Amendment. The *Kyllo* Court opined:

We think that obtaining by sense-enhancing technology any information regarding the interior of the home that could not otherwise have been obtained without physical “intrusion into a constitutionally protected area,” constitutes a search—at least where (as here) the technology in question is not in general public use. This assures preservation of that degree of privacy against government that existed when the Fourth Amendment was adopted.¹³⁰

Although the thermal imaging from *Kyllo* specifically involved an intrusion into one’s home, the body receives a similar level of heightened Fourth Amendment protection.¹³¹ Voice-based technologies like ADLAIA effectively probe inside the human body and mind to read thoughts and emotions, going far beyond currently acceptable practices, such as using a K-9 drug-sniffing dog to detect the odor of narcotics *outside* the body.¹³²

124. See *Leaders of a Beautiful Struggle v. Balt. Police Dep’t*, 2 F.4th 330, 343 (4th Cir. 2021) (finding a Fourth Amendment violation where surveillance “surpassed ordinary expectations of law enforcement’s capacity and provided enough information to deduce details from the whole of individuals’ movements”).

125. *Carpenter*, 138 S. Ct. at 2218 (quoting *Riley v. California*, 573 U.S. 373, 385 (2014)).

126. *Id.* at 2217.

127. Dery, *supra* note 98, at 219; see also Ionannis Pavlidis, Norman L. Eberhardt & James A. Levine, *Seeing Through the Face of Deception: Thermal Imaging Offers a Promising Hands-off Approach to Mass Security Screening*, 415 NATURE 35 (2002).

128. Dery, *supra* note 98, at 219.

129. 533 U.S. 27 (2001).

130. *Id.* at 34–35 (quoting *Silverman v. United States*, 365 U.S. 505, 512 (1961)).

131. As the saying goes, “the eyes are the window to the soul.” But see Dery, *supra* note 98, at 242 (concluding that thermal imaging to detect lies likely is not a Fourth Amendment search or seizure).

132. See *United States v. Place*, 462 U.S. 696, 707 (1983).

Though the application of *Kyllo* to areas outside one's home remains undecided, the case suggests that mechanisms such as ADLAIA may violate the Fourth Amendment where such detection is "sense-enhancing technology," "not in general public use," and provides police with "information . . . that could not, otherwise have been obtained without physical intrusion into a constitutionally protected area."¹³³ There is a fundamental difference between using voice analytic technology to search for outwardly publicly available information, like for identification purposes, and using it to probe into the privacy of one's thoughts and body, without consent, for evidence of criminal wrongdoing.

The concern with the current application of Fourth Amendment law to a situation in which an individual is being prompted to answer supposedly innocuous questions regarding identity is that, with artificial intelligence technology, a snippet of recorded speech is enough to have obtained permanent evidence of guilt far beyond the mere words that were spoken. The best analogy may be to brain states revealed through neuroscientific testing:

Like other information about inner bodily processes such as the contents of one's blood or urine, subjects have a "reasonable expectation of privacy" in information about their brain states. Moreover, the fact that the neuroscience tests measure brain details from outside the scalp does not destroy the analogy. One has a reasonable expectation of privacy in the details of one's home (even when measured from outside with a thermal-imaging device) and in the contents of one's telephone conversations (even when gathered with an outside listening device). Given these examples, one plainly also has a reasonable expectation of privacy in the details of what is in her head, even though the government does not have to invade the body to learn the information.¹³⁴

It is hard to argue that, under these circumstances, the information revealed by ADLAIA or similar testing could be *voluntarily* provided or *intentionally* made publicly available, beyond the limited scope of the answers given, particularly when the individual is prodded to provide information that reveals much more than his identity without being informed of the potential consequences.¹³⁵ Ultimately, the response of merely

133. *Kyllo*, 533 U.S. at 34 (internal quotation marks omitted) (quoting *Silverman*, 365 U.S. at 512); see also Sean K. Driscoll, "The Lady of the House" vs. a Man with a Gun: Applying *Kyllo* to Gun-Scanning Technology, 62 CATH. U. L. REV. 601, 642 (2013) (discussing Fourth Amendment concerns involving gun-scanning technology).

134. Michael S. Pardo, *Neuroscience Evidence, Legal Culture, and Criminal Procedure*, 33 AM. J. CRIM. L. 301, 325 (2006) (footnotes omitted).

135. See *id.* at 325–26; Christian M. Halliburton, *How Privacy Killed Katz: A Tale of Cognitive Freedom and the Property of Personhood as Fourth Amendment Norm*, 42 AKRON L. REV. 803, 840 (2009) (arguing that technology that accesses the inner workings of the brain and body presents

providing one's name may be sufficient to amount to a search of the private sphere of one's mind and physical state and the implication of a crime. Thus, testing one's voice to reach the inner status of his body or mind, though not physically invasive, is a substantial dignity violation. The Supreme Court has observed that intrusions that do no harm to an individual's physical person may nonetheless "damage the individual's sense of personal privacy and security" and will, therefore, trigger Fourth Amendment protection.¹³⁶ Akin to using thermal imaging to search a home or devices to eavesdrop on phone conversations, using artificial intelligence to "read" the state of one's mind and body may infringe upon a person's right to privacy in a non-physical manner and is deserving of Fourth Amendment protection.¹³⁷

2. Deception or Coercion as Seizure

In addition to searches, the Fourth Amendment guards against "seizures" of the person, such as that which occurs when an individual possesses an objective reason to believe that he is not free to leave.¹³⁸ Here too, ADLAIA suggests a departure from current Fourth Amendment law in that the individual is effectively placed in a position where his voice is being forced, and not voluntarily offered, to the public, further implicating Fourth Amendment expectations. The clandestine use of artificial intelligence technologies may be utilized in a way that amounts to a seizure, not a consensual encounter, negating the historic approach to the voice as a public attribute.¹³⁹

The Court also considered the question of consent in *Carpenter*, in the context of cell phone records. The Court pointed out first, that "[c]ell phone location information is not truly 'shared' as one normally understands the term" because of the pervasiveness and necessity of carrying a phone.¹⁴⁰ Second, cell phones track locations without any affirmative action from users, and it is impossible to disable this feature without disconnecting the

"a challenge to the Fourth Amendment's ability to preserve our cognitive landscape as a zone of exclusion that it is incapable of meeting in its current form").

136. *Winston v. Lee*, 470 U.S. 753, 761–62 (1985) (dividing an individual's "dignitary interests" into "personal privacy and bodily integrity").

137. Madison Kilbride & Jason Iuliano, *Neuro Lie Detection and Mental Privacy*, 75 MD. L. REV. 163, 191–92 (2015).

138. *United States v. Mendenhall*, 446 U.S. 544, 554 (1980).

139. Amanda C. Pustilnik, *Neurotechnologies at the Intersection of Criminal Procedure and Constitutional Law*, in *THE CONSTITUTION AND THE FUTURE OF CRIMINAL JUSTICE IN AMERICA* 109, 113 (John T. Parry & L. Song Richardson eds., 2013) ("Neurotechnologies that allow investigators to obtain information by bypassing an individual's voluntary speech or other forms of voluntary communication impinge on several constitutional protections, notably the Fourth Amendment protection against unreasonable search and seizure and the Fifth Amendment privilege against self-incrimination.").

140. *Carpenter v. United States*, 138 S. Ct. 2206, 2220 (2018).

phone.¹⁴¹ By analogy, the information accessible by using algorithmically enhanced analysis of one's voice is not "shared" in the sense that one voluntarily shares his voice when speaking with friends. And, where one speaks without the knowledge that his words are being subjected to technological scrutiny, he may assert his words are not consensual.

Yet, couldn't one simply refuse to speak? Arguably, yes. The purpose of the Fourth Amendment is not to eliminate all contact between the government and the private citizen but, rather, to "prevent arbitrary and oppressive interference by enforcement officials with the privacy and personal security of individuals."¹⁴² So long as a person remains free to disregard police questions and walk away, no seizure has occurred.¹⁴³ As the Court has recognized, "[t]he person approached . . . need not answer any question put to him; indeed, he may decline to listen to the questions at all and may go on his way. . . . If there is no detention—no seizure within the meaning of the Fourth Amendment—then no constitutional rights have been infringed."¹⁴⁴ The reality, however, is not quite so simple.

Despite its "free to walk leave" stance, the Court historically has concluded that interrogation related to identity (or request for identification) is not a seizure.¹⁴⁵ Generally, suspicionless identification is not a seizure unless the identified person is physically detained, his freedom of movement restrained.¹⁴⁶ In addition, the Court has taken the position that "[u]nless the circumstances of the encounter are so intimidating as to demonstrate that a reasonable person would have believed he was not free to leave if he had not responded, one cannot say that the questioning resulted in a detention under the Fourth Amendment."¹⁴⁷ That precedent may have been reasonable when providing one's name and other basic facts meant exactly, and only, what was said. Now, however, "answering questions" has a deeper meaning.

Yet another hurdle exists: Even if it is recognized that search and/or seizure occurs in the gathering and analyzing of voice, suspicionless seizures have been permitted under certain circumstances.¹⁴⁸ For example, in *Michigan Department of State Police v. Sitz*,¹⁴⁹ the Supreme Court addressed the constitutionality of sobriety checkpoints that briefly stopped and tested

141. *Id.*

142. *Mendenhall*, 446 U.S. at 553–54 (1980) (quoting *United States v. Martinez-Fuerte*, 428 U.S. 543, 554 (1976)).

143. Dery, *supra* note 98, at 227–28 (quoting *Mendenhall*, 446 U.S. at 554).

144. *Florida v. Royer*, 460 U.S. 491, 497–98 (1983).

145. Dery, *supra* note 98, at 229 (quoting *Immigr. & Naturalization Serv. v. Delgado*, 466 U.S. 210, 216 (1984)).

146. *Mendenhall*, 446 U.S. at 553.

147. *Delgado*, 466 U.S. at 216.

148. *City of Indianapolis v. Edmond*, 531 U.S. 32, 34 (2000).

149. 496 U.S. 444, 447 (1990).

each driver for intoxication. The Court balanced the brief inconvenience to the individuals against the state's interest in decreasing alcohol-related highway deaths to permit sobriety checkpoint stops absent reasonable suspicion, concluding that the brief, suspicionless seizures were constitutional.¹⁵⁰ Under this rationale, widespread use of ADLAIA-like technology could be run through crowds in bars or in sporting events, under the guise of detecting and preventing drunk driving, without an advanced requirement of reasonable suspicion. And, where ADALIA-related technology is used to combat the "magnitude of the drunken driving problem," a brief seizure may be excused, as its purpose goes beyond that of mere crime control.¹⁵¹

3. Negating Presumption of Innocence and Creating Reasonable Suspicion and Probable Cause

Issues of the presumption of innocence and its rebuttal, through reasonable suspicion and probable cause, accompany Fourth Amendment concerns regarding ADLAIA. With respect to criminal convictions, courts dispute "whether compelling a defendant to restate words heard at the scene of the crime is unduly suggestive of guilt, and thus violative of the presumption of innocence."¹⁵² But, what about using voice or, more specifically, results from an algorithmically analyzed voice sample, to *establish* reasonable suspicion or probable cause in the first place? It is entirely conceivable that law enforcement vehicles or police body cameras could be equipped with ADLAIA technology as a precursor to standardized field sobriety tests and breathalyzer testing and in lieu of a portable breath test. ADLAIA testing could be performed as a matter of course in every traffic stop, even absent reasonable suspicion of impaired driving, in conjunction with law enforcement's gathering of preliminary driver information such as a person's name and address. Traffic stops are regularly recorded through officer-worn body cameras and patrol vehicle dash-cams, so incorporating an ADLAIA recording device would take little effort. Indeed, this recording could occur during all routine interactions with law enforcement. If ADLAIA-like technology continues to be categorized as falling outside one's Fourth Amendment protections, then there is no

150. *Sitz*, 496 U.S. at 450–52; see Fretty, *supra* note 106, at 461–62 (discussing *Sitz*). The Court since narrowed its holding in *Sitz*, clarifying that suspicionless checkpoints must have a primary purpose beyond "general interest in crime control," like roadway safety or the policing of the border. *Edmond*, 531 U.S. at 41–42. The Court struck down a narcotics checkpoint program because it was mainly designed "to uncover evidence of ordinary criminal wrongdoing." *Id.* at 41–42.

151. See *Sitz*, 496 U.S. at 451.

152. Michael A. Connor, *The Constitutional Framework Limiting Compelled Voice Exemplars: Exploration of the Current Constitutional Boundaries of Governmental Power over a Criminal Defendant*, 33 SAN DIEGO L. REV. 349, 374 (1996).

preliminary threshold required before the Government can subject one to such analysis to establish reasonable suspicion or probable cause for further detention.

Concepts of reasonable suspicion and probable cause require law enforcement to utilize and articulate the perceptions of a reasonably objective police officer under a totality-of-the-circumstances approach to determine if more investigation, or even detention, is warranted.¹⁵³ Mere conclusory statements will not suffice.¹⁵⁴ However, accepting, for a moment, that ADLAIA-like technology can be lawfully used in such a manner, reliance on said testing equates to law enforcement reliance on matters beyond their personal observations. Much like the use of anonymous informant tips and canine alerts, some degree of reliability or accuracy should be required.¹⁵⁵ As to the latter, courts regularly review factors like “the reliability of the informant, the basis for the informant’s information, and the extent to which the police have corroborated the tip” in determining if the necessary hurdles have been satisfied before a citizen’s freedoms may be interrupted.¹⁵⁶ Perhaps, similarly, audio-based intoxication testing should require law enforcement observation of suspicious behavior before it is permitted. Informants and canine alerts present analogous situations where a lack of trust regarding the source and reliability of information may raise questions as to the legitimacy of the claimed reasonable suspicion or probable cause.¹⁵⁷ For the discussion herein about the disparate efficacy and inherent bias of ADLAIA and similar technology, the real issue, to which there has been no answer to date, is at what level has the technology achieved an acceptable and tolerable rate of error?¹⁵⁸

Of course, the burden for a conviction (beyond a reasonable doubt) differs from that of an investigatory detention (reasonable suspicion) or even an arrest (probable cause), and “[t]he Supreme Court has long held that probable cause is not a preponderance-of-the-evidence standard.”¹⁵⁹ Looking to canine alerts for comparison, even where false positives have approached fifty percent in extreme cases, most courts permit the alert to justify a Fourth

153. *Illinois v. Gates*, 462 U.S. 213, 232 (1983) (noting that evidence establishing probable cause or reasonable suspicion “must be seen and weighed not in terms of library analysis by scholars, but as understood by those versed in the field of law enforcement” (quoting *United States v. Cortez*, 449 U.S. 411, 418 (1981))).

154. *Id.* at 239.

155. See *Kakade*, *supra* note 57, at 806.

156. *SANTAMARIA*, *supra* note 24, at 20.

157. *Id.* at 19–21; see *Florida v. Harris*, 568 U.S. 237, 244 (2013).

158. See *infra* Section II.D.

159. *Fretty*, *supra* note 106, at 460.

Amendment search.¹⁶⁰ The same application has occurred with respect to standardized field sobriety tests, which also contain risks of false positives. For example, the Horizontal Gaze Nystagmus, even when administered by trained officers, can falsely indicate intoxication in about twenty-three percent of the cases; yet courts overwhelmingly permit its consideration as a basis for detaining an individual.¹⁶¹ The result may well be that reliance on ADLAIA-related technology will be permitted so long as it is reliable a substantial percentage of the time, though what that percentage is and who establishes it as “substantial” remains to be seen.

Given the maxim “correlation is not causation,” the reliability of audio-based artificial intelligence for detecting inebriation may require additional scrutiny.¹⁶² For example, a court may wish to consider the reported accuracy rate of a particular technology, the quality of the recording, and whether an officer corroborated the results with personal observations.¹⁶³ A relatable instance of mistake occurred in *Graham v. Connor*,¹⁶⁴ wherein Dethorne Graham, a diabetic, went to a grocery store to get orange juice after he felt he was having an insulin reaction, at which time Graham’s unusual behaviors drew the attention of law enforcement.¹⁶⁵ If Graham simply had been

160. *Id.* at 459 (collecting sources); see *United States v. Donnelly*, 475 F.3d 946, 955 (8th Cir. 2007) (probable cause existed where canine was properly trained and handled, even with 46% inaccuracy rate); *United States v. Scott*, 610 F.3d 1009, 1014 (8th Cir. 2010) (probable cause existed even with dog’s 15% error rate in the field); *United States v. Ohoro*, 724 F. Supp. 2d 1191, 1203–04 (M.D. Ala. 2010) (referencing unpublished decision finding a 45% error rate acceptable); *United States v. Linares*, 269 F.3d 794, 797 (7th Cir. 2001) (38% failure rate held sufficient); *United States v. Koon Chun Wu*, 217 F. App’x 240, 246 (4th Cir. 2007) (probable cause upheld despite dog’s 40% failure rate). Some courts have set a higher bar for canine accuracy. See *Commonwealth v. Ramos*, 894 N.E.2d 611, 613 (App. Ct. Mass. 2008) (no probable cause where alert by K-9 with only five-to-six correct identifications and two false alerts in the past six months); *United States v. Huerta*, 247 F. Supp. 2d 902, 910 (S.D. Ohio 2002) (65% accuracy rate for drug-dog was insufficient for probable cause).

161. *Fretty*, *supra* note 106, at 460 n.267 (citing *United States v. Horn*, 185 F. Supp. 2d 530, 537 (D. Md. 2002)); see also Jim Fraiser, Annotation, *Vertical Gaze Nystagmus Test: Use in Impaired Driving Prosecution*, 117 A.L.R.5th 491 (2004).

162. See, e.g., *In re Mirena IUS Levonorgestrel-Related Prod. Liab. Litig.* (No. II), 387 F. Supp. 3d 323, 349–50 (S.D.N.Y. 2019), *aff’d*, 982 F.3d 113 (2d Cir. 2020) (“[A] lay jury certainly cannot be counted on to individually evaluate and collectively weigh these factors in a suitably scientifically rigorous manner, one that avoids the risk of conflating correlation with causation.”); *Schafersman v. Agland Coop*, 631 N.W.2d 862, 871 (Neb. 2001) (“[T]he assumption that correlation proves causation presents fallacious post hoc propter hoc reasoning that cannot be said to be helpful to the trier of fact”); *In re Bair Hugger Forced Air Warming Devices Prod. Liab. Litig.*, No. MDL152666JNEDTS, 2019 WL 4394812, at *16 (D. Minn. July 31, 2019), *aff’d in part and rev’d in part*, 9 F.4th 768 (8th Cir. 2021) (“[T]he court found that the report inappropriately treated the correlation as ‘affirmative evidence of causation’ and excluded the expert’s testimony”).

163. SANTAMARIA, *supra* note 24, at 21.

164. 490 U.S. 386 (1989).

165. *Id.* at 388–89.

subjected to ADLAIA voice analysis, without more, he may have wrongly been deemed inebriated and arrested because common symptoms of hypoglycemia include slurred or abnormal speech.¹⁶⁶ Would these algorithmic results have shaded an officer's formulation of reasonable suspicion and treatment of Graham, perhaps even endangering his health and life, under the all-too-easy quick judgment of a machine?¹⁶⁷

Significantly, the risk of error is not the same for everyone. As will be addressed herein, audio-based inebriation identification is not equally flawed across the spectrum of individuals it encounters.¹⁶⁸ Differences in gender, race, size, language, anatomy, and other factors affect the accuracy of test results.¹⁶⁹ Flaws in the original data inputs can unintentionally create or amplify biases, resulting in greater inaccuracies for those who differ from the original control groups used to create the algorithms.¹⁷⁰ The results suggest that intoxication could be distorted due to inherent partiality and selectivity, which may translate into discrimination and unfair treatment of particular groups.¹⁷¹ Technology unwittingly could lead to judging individuals based on correlations and inferences, rather than causation and observation.¹⁷²

B. Fifth Amendment: Self-Incrimination

One of the most compelling issues surrounding the use of audio-based deep learning algorithms to detect alcohol inebriation is the potential infringement on self-incrimination protections. The Fifth Amendment of the United States Constitution states, in part: "No person . . . shall be compelled in any criminal case to be a witness against himself . . ."¹⁷³ At its core, the privilege against self-incrimination, founded on the presumption of innocence, equates to a principle that evidence against the accused should be derived from sources other than the accused himself.¹⁷⁴ Thus, Fifth

166. See *State v. Gatien*, 688 N.E.2d 54, 56 (Ohio Mun. Ct. 1997) (overturning DUI conviction because defendant's symptoms could have been caused by his diabetes).

167. See Kakade, *supra* note 57, at 807–08.

168. See *infra* Section II.D.

169. For a discussion of similar concerns in the context of facial recognition technology, see SANTAMARIA, *supra* note 24, at 2; Kerri A. Thompson, *Countenancing Employment Discrimination: Facial Recognition in Background Checks*, 8 TEX. A&M L. REV. 63, 74 (2020); Rachel S. Fleischer, *Bias in, Bias Out: Why Legislation Placing Requirements on the Procurement of Commercialized Facial Recognition Technology Must Be Passed to Protect People of Color*, 50 PUB. CONT. L.J. 63, 70 (2020).

170. Francesca Galli, *Law Enforcement and Data-Driven Predictions at the National and EU Level: A Challenge to the Presumption of Innocence and Reasonable Suspicion?*, in CONSTITUTIONAL CHALLENGES IN THE ALGORITHMIC SOCIETY, *supra* note 47, at 111, 123.

171. *Id.*

172. *Id.*

173. U.S. CONST. amend. V.

174. Behura & Behura, *supra* note 50, at 399.

Amendment privilege is violated by compulsion of an incriminating testimonial communication.¹⁷⁵

1. The Use of One's Body as an Incriminating Tool

Some have argued that “[c]ompulsory voice identification is on the borderline between compulsion of identification data about the body of the accused and testimonial compulsion.”¹⁷⁶ Now, in the context of the use of ADLAIA during a police-citizen encounter, the technology recording the speaker’s voice may not only identify him; it may also conclude he is intoxicated, potentially implicating him of a crime on the basis of his speech alone. His body has been used against him, perhaps even as a result of answering seemingly innocuous initial questions.

However, over a century ago, the Supreme Court dismissed any Fifth Amendment implications of the inculpatory use of one’s body as evidence when a defendant was required to try on a blouse associating him with a murder.¹⁷⁷ In *Holt v. United States*,¹⁷⁸ the Court recognized a line between the Fifth Amendment’s “prohibition of compelling a man in a criminal court to be witness against himself,” which forbade using “physical or moral compulsion to extort communications,” and the separate issue of using “his body as evidence when it may be material.”¹⁷⁹ The *Holt* decision eventually led the Court to its position in *Schmerber v. California*,¹⁸⁰ where it considered whether being forced to give blood for alcohol testing equated to a compulsion to be a witness against oneself.¹⁸¹ While the Court reasoned that the privilege against self-incrimination reached “an accused’s communications, whatever form they might take,” it also concluded that the Fifth Amendment offered “no protection against compulsion to submit to fingerprinting, photographing, or measurements, to write or speak for identification, to appear in court, to stand, to assume a stance, to walk, or to

175. See e.g., *Schmerber v. California*, 384 U.S. 757, 760–61 (1966).

176. Leroy F. Fuller, *Evidence — Self-Incrimination — Admissibility of Compulsory Voice Identification*, 27 N.C. L. REV. 262, 265 (1949); see Connor, *supra* note 152, at 360–65.

177. State courts originally interpreted the right more expansively. Connor, *supra* note 152, at 358 (collecting sources); see, e.g., *Stokes v. State*, 64 Tenn. 619, 621 (1875) (defendant not required to place his foot in a pan of mud brought into court); *Turman v. State*, 95 S.W. 533, 536 (1906) (defendant could not be compelled to don a cap); *Reyes v. Municipal Court*, 41 P.R. 892, 893, 897 (1931) (defendant could not be compelled to dishevel his hair). Likewise, the Supreme Court initially took a narrower view, holding, for example, that compelled production of documents violated privilege against self-incrimination. See *Boyd v. United States*, 116 U.S. 616, 638 (1886).

178. 218 U.S. 245 (1910).

179. *Id.* at 252–53; see Dery, *supra* note 98, at 233.

180. 384 U.S. 757 (1966).

181. *Id.* at 759.

make a particular gesture.”¹⁸² The distinction drawn by the Court categorized evidence into (privileged) communicative/testimonial evidence versus (nonprivileged) real/physical evidence.¹⁸³ Currently, the sound of one’s voice, as opposed to the content of one’s answers, is physical, not testimonial, and, thus, not subject to Fifth Amendment protection.

Schmerber seems to end any possibility that the compulsion to use one’s voice (literally) could implicate Fifth Amendment self-incrimination protections. Even later, the Court recognized that, while one’s voice is a means of communication, not every compulsion of an accused to use his voice falls within the privilege.¹⁸⁴ The current state of protection for one’s literal voice is reflected in *Pennsylvania v. Muniz*,¹⁸⁵ wherein the Court concluded that the “slurring of speech” only demonstrates the “physical inability to articulate words in a clear manner due to ‘the lack of muscular coordination of his tongue and mouth.’”¹⁸⁶ The Court explained, “[i]t is the ‘extortion of information from the accused,’ the attempt to force him to ‘disclose the contents of his own mind,’ that implicates the Self-Incrimination Clause.”¹⁸⁷ Slurred speech, it concluded, was a physical characteristic and not testimonial, thus such speech is not protected under the Fifth Amendment. Likewise, courts have held that the forced repetition of phrases is not testimonial, as it offers only physical evidence of the defendant’s voice.¹⁸⁸ “Under this rationale, the Fifth Amendment only protects the affirmative act of transmitting information. In order for evidence to be testimonial, suspects must engage in active and intentional communication, and they must exert control over their actions.”¹⁸⁹ Under the current state of the law, courts may interpret algorithmically enhanced voice analysis as simply a form of physical evidence—just another voice exemplar which can be compelled by the Government.

But, what if ADLAIA reveals the contents of one’s mind in addition to the condition of his body? In that case, the use of ADLAIA-like technology may violate the Fifth Amendment, particularly given the distinction “between the suspect’s being compelled himself to serve as evidence and the suspect’s

182. *Id.* at 763–64; *see also* Conner, *supra* note 152, at 361 (“[C]ourts have allowed a defendant to be compelled to reenact a crime, dye her hair, furnish a handwriting sample, perform a sobriety field test, wear an outfit or costume and shave a beard or mustache.” (footnotes omitted)).

183. Dery, *supra* note 98, at 234; *see also* Kiel Brennan-Marquez, *A Modest Defense of Mind Reading*, 15 YALE J.L. & TECH. 214, 221–22 (2013); Behura & Behura, *supra* note 50, at 395.

184. Dery, *supra* note 98, at 236; *see also* Gilbert v. California, 388 U.S. 263, 266 (1967).

185. 496 U.S. 582 (1990).

186. *Id.* at 590, 592.

187. *Id.* at 594 (quoting *Schmerber*, 487 U.S. at 210–11).

188. Conner, *supra* note 152, at 362.

189. Erin B. Pulice, Note, *The Right to Silence at Risk: Neuroscience-Based Lie Detection in the United Kingdom, India, and the United States*, 42 GEO. WASH. INT’L L. REV. 865, 884 (2010).

being compelled to disclose or communicate information or facts that might serve as or lead to incriminating evidence,”¹⁹⁰ the latter of which is protected.¹⁹¹ First, compare the use of ADLAIA technology to detect inebriation in the voice to the use of thermal imaging to detect deceit in the eyes, where law enforcement is observing the physiological response (heat to the eyes) to questioning as an indicator of deceit. Thus, thermal imaging likely falls within the realm of privileged tests, imagined by the *Schmerber* Court, “that seem to collect only physical evidence” but “are in actuality ‘eliciting responses which are essentially testimonial.’”¹⁹² The government is using a person’s physiological responses to weigh his guilt or innocence; the heat to his face reveals his deception.¹⁹³ As the Court stated in *Schmerber*, when the government attempts “to determine guilt or innocence on the basis of physiological responses, whether willed or not,” it “evoke[s] the spirit and history of the Fifth Amendment.”¹⁹⁴

Another comparison may be helpful. “Brain fingerprinting” is a process wherein brain waves are analyzed for the presence of “event-related potentials,” which, in turn, suggest whether certain knowledge is present in the brain.¹⁹⁵ While, at first blush, the results of brain fingerprinting appears to be merely physical evidence (brain waves) with no testimonial properties:

[b]y its very operation, Brain Fingerprinting forces a suspect to reveal the contents of his mind by detecting whether certain facts and relevant knowledge exist in the brain. . . . As a result of this analysis, the suspect has been compelled to disclose any incriminating knowledge he may have concerning his role in the crime.¹⁹⁶

190. *Doe v. United States*, 487 U.S. 201, 211 n.10 (1988).

191. Brennan-Marquez, *supra* note 183, at 229–30.

192. Dery, *supra* note 98, at 247–48 (quoting *Schmerber*, 384 U.S. at 764).

193. *Id.* Opponents would argue that ADALIA is nontestimonial in that it analyzes speech patterns for intoxication. This Article suggests that it is something more in that, given a speaker’s ability to choose to remain silent (which may result in negative consequences), to alter their voice (which may indicate deceit), or to speak as they normally would (which may indicate guilt). It is not the choice of words that matters, but how the speaker portrays them, that reveals the contents of the mind. By way of example, every child can distinguish between a parent’s answer of “I’ll think about it” being an absolute “no” versus a door open to possibilities, simply by the parent’s tone of voice. The words are the same, but the content and meaning differ drastically by the speech. See Kitai-Sangero, *supra* note 108, at 315; Taslitz, *supra* note 62, at 134 (2008) (“Concisely (and perhaps therefore misleadingly) stated, my theory is this: the privilege against self-incrimination serves to protect the literal and metaphorical voice of those ensnared in the criminal process. By “literal voice,” I mean the physical qualities of the human voice—its pitch, tone, rate, and timbre—and the content of its aural message, the precise words chosen and their likely perceived meaning.”).

194. *Schmerber*, 384 U.S. at 764.

195. Jody C. Barillare, *As Its Next Witness, the State Calls . . . the Defendant: Brain Fingerprinting as “Testimonial” Under the Fifth Amendment*, 79 TEMP. L. REV. 971, 975 (2006).

196. *Id.* at 990–94.

Again, technology permits the government a glimpse into an individual's mind based on his physiological responses to questioning, not the content of his answers.

ADLAIA may fall within the same category of testing as thermal imaging or brain fingerprinting. With audio-based algorithmic analysis, one's voice is not the "statement"; it merely serves as the basis for the conclusion of the physical condition of intoxication. The statement is the status of one's mind, as revealed by the application of artificial intelligence but made possible only through speech. Because people generally are conscious of their general physical condition—including speed, pronunciation, and tone of speech—biometric analysis of speech may, indeed, reveal the contents of their minds, particularly where they consciously undertake to manipulate their speech to avoid detection. As one circuit judge has argued:

[I]n giving a voice sample, one also admits that one's voice has various characteristic idiosyncrasies—a non-obvious and incriminating fact that the law allows the prosecutor to secure by compulsion. . . . One can, of course, discern a communicative element in the giving of a voice sample: a person commanded to speak implicitly says, "This is the way I sound when I speak."¹⁹⁷

Thus, an accused may change his rate, tone, pitch, and pronunciation to consciously prevent confirmation of any suspicions. On the other hand, to consciously speak in a normal manner "might be analogous to revealing the contents of one's mind. It would then follow that compelling voice recognition would be analogous to compelling a suspect to reveal something testimonial in nature, which some courts have held to violate the privilege against self-incrimination."¹⁹⁸

The Supreme Court has stated that the privilege against self-incrimination reflects an "unwillingness to subject those suspected of crime to the cruel trilemma of self-accusation, perjury or contempt."¹⁹⁹ The intent is to protect a guilty party from deciding between "*incrimination* (in case of an honest confession), *perjury* (in case of a false proclamation of innocence), and *contempt* (in case of the decision to remain silent)."²⁰⁰ Where an individual unknowingly submits himself to clandestine ADLAIA testing, his right to silence has been taken away, likely leaving him only the realities of incrimination (by speaking normally), as he would have no motivation to lie.

197. *United States v. Hubbell*, 167 F.3d 552, 598 (D.C. Cir. 1999) (Williams, J., dissenting), *aff'd*, 530 U.S. 27 (2000).

198. Erin M. Sales, *The "Biometric Revolution": An Erosion of the Fifth Amendment Privilege to Be Free from Self-Incrimination*, 69 U. MIAMI L. REV. 193, 230 (2014) (footnote omitted).

199. *Pennsylvania v. Muniz*, 496 U.S. 582, 596 (1990).

200. Brennan-Marquez, *supra* note 183, at 266–67.

On the other hand, where he is mandated to submit to ADLAIA testing, he is only left with the options of incrimination or perjury (by use of deception to alter his voice).

Furthermore, with further development of such technology, even deception may no longer be an option. The act of speaking itself may communicate the contents of his mind and body, whether he wants to or not:

[M]erely by speaking we can also convey much that we might prefer to hide. The sound of our voice can reveal illness, intoxication, exhaustion, social class, education, and sexual desire. Our voice can encourage intimacy or distance, instill confidence or fear, undermine or support an opponent or friend, and does so frequently without our conscious awareness or willingness to do these things.²⁰¹

Science may have outmaneuvered the human body and brain by detecting an individual's conscious efforts to alter his mental and physical state. The speaker no longer has the ability to choose between the truth and a lie; his voice makes that decision for him.²⁰² Oral statements, when so analyzed, may well lead to the contents of one's mind. The analysis produces "testimonial like" evidence, captured in physical form (the voice recording), the results of which may well reveal both physical and mental states.²⁰³

This situation is no longer akin to merely providing a voice exemplar for identification purposes. As observed in the context of brain imaging to detect lying, "[t]his form of evidence challenges the already fuzzy line between testimonial and physical evidence."²⁰⁴ Where the incriminating inference about the mental state of an individual is "drawn from" a testimonial communication (answering identity questions), it should be privileged.²⁰⁵ Were the suspect permitted to remain silent, the information regarding the state of his mental and physical being would not be revealed. In fact, this evidence of guilt can be disclosed only through the use of the declarant's voice, as amplified beyond that available to the human eye or ear. The lines between physical and testimonial have blurred.²⁰⁶ In Supreme Court

201. Taslitz, *supra* note 62, at 164 (footnotes omitted); see Nicholas Soares, Note, *The Right to Remain Encrypted: The Self-Incrimination Doctrine in the Digital Age*, 49 AM. CRIM. L. REV. 2001, 2005 (2012).

202. Dery, *supra* note 98, at 247–48; Kitai-Sangero *supra* note 108, at 305.

203. Interestingly, support for this argument can be traced back to *Schmerber*, wherein Justice Brennan commented that the Fifth Amendment prevents determining a suspect's "guilt or innocence on the basis of physiological responses." *Schmerber v. California*, 384 U.S. 757, 764 (1966).

204. Pulice, *supra* note 189, at 891.

205. Christos D. Strubakos, *Raze Out the Written Troubles of the Brain: The Constitutional Issues with Reading the Brain Waves of Domestic Terrorism Detainees*, 33 ALB. L.J. SCI. & TECH. 303, 332 (2023).

206. Antonio Vayas, *Say Cheese: How the Fourth Amendment Fails to Protect Your Face*, 51 SETON HALL L. REV. 1639, 1659 (2021) (discussing the use of passcodes and biometrics).

parlance, if the Fifth Amendment is meant to protect a “private inner sanctum of individual feeling and thought,”²⁰⁷ and the Court defines testimony as the “contents of [one’s] mind,”²⁰⁸ then ADLAIA-like test results may be protected, even where the condition of the body, is being used to “speak his guilt.”²⁰⁹ So, while an ADLAIA situation would be less dependent on the content of the answer, it very much would compel the speaker to communicate evidence of guilt.²¹⁰ The direct access to a person’s physical and mental states available through ADLAIA and similar technology allows uninvited intrusion on “mental privacy,” in conflict with Fifth Amendment protections.²¹¹ Regardless of literal content, the voice reveals testimonial information about “biological, psychological, and social status.”²¹² It would seem, then, that some level of Fifth Amendment protection should apply.²¹³

2. Consent and Voluntariness of Confessions

Just about everyone is familiar with the advisements required by *Miranda v. Arizona*,²¹⁴ including the right to remain silent. Designed, in relevant part, to protect an individual’s Fifth Amendment right not to incriminate himself, *Miranda* requires the government to warn defendants who are in custody of certain rights (the right to remain silent and the right to legal counsel) before asking for a waiver of those rights and before

207. *Couch v. United States*, 409 U.S. 322, 327 (1973).

208. *Doe v. United States*, 487 U.S. 201, 211 (1988) (quoting *Curcio v. United States*, 354 U.S. 118, 128 (1957)).

209. *Id.* (quoting *United States v. Wade*, 388 U.S. 218, 222–23 (1967); see Dery, *supra* note 98, at 238; Pulice, *supra* note 189, at 891).

210. See Dery, *supra* note 98, at 239–40; see also Kitai-Sangero, *supra* note 108, at 320–22 (“Even if a reliable lie detector capable of reading thoughts is developed, the privilege against self-incrimination should protect accused persons from being forcibly subjected to it.”).

211. See Pulice, *supra* note 189, at 887 (discussing a neuroscience-based lie detection test known as “Brain Electrical Oscillation Signature” as violative of Fifth Amendment rights).

212. Taslitz, *supra* note 62, at 164 (quoting ANNE KARPf, *THE HUMAN VOICE: HOW THIS EXTRAORDINARY INSTRUMENT REVEALS ESSENTIAL CLUES ABOUT WHO WE ARE* 10 (2006)).

213. See *id.* at 205–06; Kitai-Sangero, *supra* note 108, at 315–16. In circumstances where the government uses ADLAIA-technology to test for intoxication but no criminal charges result, the privilege likely would not apply. In *Chavez v. Martinez*, the Supreme Court made clear that the Fifth Amendment prevents compulsion only after the initiation of criminal proceedings, not merely police interrogations. 538 U.S. 760, 766–67 (2003). Certainly, though, an individual may be subject to negative consequences of such testing, including possible implications for his reputation, employment, and ability to possess a valid driver’s license. As one scholar summarized:

In sum, one powerful justification for the privilege [against self-incrimination], therefore, is this: it guards against the compelled articulation of words that raise a risk of *both* undue state intervention in the very creation of the speaker’s essential nature and the resulting extreme social stigma and social misdefinition of personality that result from the prospect of being judged by the criminal justice system.

Taslitz, *supra* note 62, at 136.

214. 384 U.S. 436 (1966).

interrogating the individual.²¹⁵ If an individual is not “in custody” or if no “interrogation” has occurred, then *Miranda* is irrelevant.²¹⁶ And, because one’s voice historically has been considered non-testimonial, it generally falls outside the parameters of *Miranda*.²¹⁷

However, even where *Miranda* advisements are not required, a confession must be voluntarily given to be admissible. To qualify as voluntary, a confession must be “the product of a rational intellect and a free will.”²¹⁸ Ironically, intoxication is a factor to consider in the totality of the circumstances and can lead to a finding of involuntariness.²¹⁹ This situation begs the question as to whether an inebriated individual can voluntarily submit to ADLAIA testing in the first place. Nevertheless, beyond considerations of intoxication, “the Supreme Court has refused to accept guilty pleas made without a complete understanding of the consequences and alternatives.”²²⁰ Perhaps ADLAIA confessions secured by means of deception should garner the same attention. If, for example, ADLAIA technology were utilized unknowingly during an individual’s interactions with law enforcement, he is unaware of the potential consequences of speaking, regardless of what is being said. As has been aptly summarized:

Accused persons have a right to be protected from having their will bent. They have a right to think or to say: “I am not playing this game. You believe I am guilty and may violate my rights through eavesdropping and detention, but you may not inhibit my free will and force me to cooperate with you.”

Accused persons may shape their defense by controlling their physical reactions and their statements.²²¹

To require a suspect to answer any questions, even innocuous ones, could amount to an involuntary confession after subjecting that answer to algorithmically enhanced analysis. Historically, “compulsion” has been associated with subjecting the individual from whom the action is demanded to “atypical and significant hardship[s],”²²² but how would this play into a situation where the patron speaks in order to get his bar tab or his car keys, while unknowingly being recorded to detect for intoxication? Of course, if

215. *Id.* at 467–68; see also Michele Fields, *Legal and Constitutional Issues Related to Detection*, in ISSUES AND METHODS IN THE DETECTION OF ALCOHOL AND OTHER DRUGS, at C-1, C-10 to C-11 (2000) (discussing *Miranda* rights in the context of DUI/DWI prosecutions).

216. See *Miranda*, 384 U.S. at 444.

217. Fields, *supra* note 215, at C-10 to C-11.

218. *Mincey v. Arizona*, 437 U.S. 385, 398 (1978) (quoting *Townsend v. Sain*, 372 U.S. 293, 307 (1963)).

219. DAVID M. NISSMAN & ED HAGEN, *LAW OF CONFESSIONS* § 2:16 (2d ed. 2023).

220. Donald A. Dripps, *Against Police Interrogation — and the Privilege Against Self-Incrimination*, 78 J. CRIM. L. & CRIMINOLOGY 699, 704 (1988).

221. Kitai-Sangero, *supra* note 108, at 325.

222. *McKune v. Lile*, 536 U.S. 24, 37 (2002) (citations omitted).

the bar or restaurant is only using ADLAIA technology for private purposes, constitutional restraints are of no import, but that may change if law enforcement gains access to such information.²²³ Under that circumstance, has the individual been compelled to confess? Can his statements be deemed voluntary?

More notably, how might notions of voluntariness impact being asked to give law enforcement preliminary information upon contact, consensual or otherwise, where an individual is unaware of the implementation of ADLAIA?²²⁴ Certainly, he is choosing to speak, but just as certainly, he is not choosing to reveal the extent information made available through ADLAIA. In *Hiibel v. Sixth Judicial District Court of Nevada*,²²⁵ an officer responding to a tip asked a man on the scene for identification—eleven times. When the man refused to answer, he was arrested for obstructing a public officer’s discharge of his duties.²²⁶ In affirming the conviction, the Court characterized the demand for identification, which arguably could be complied with through speech or the provision of written identification, as “so insignificant in the scheme of things as to be incriminating only in unusual circumstances.”²²⁷ The same cannot be true when twelve seconds of content-neutral speech now may result in criminal charges for driving under the influence of alcohol or a variety of other crimes.²²⁸

To be clear, it is not the act of requiring one to answer the questions that is compelled or involuntary but, rather, the act of requiring that person

223. See Anthony G. Scheer, *A Search by Any Other Name: Fourth Amendment Implications of a Private Citizen’s Actions in State v. Sanders*, 69 N.C. L. REV. 1449, 1450 (1991) (“When the police encourage a private citizen to aid in the enforcement of the law, the citizen often conducts a search. A court faced with such a situation must decide if the relationship between the citizen and the police rises to the level of agency. If it does, the court must subject the search to fourth amendment scrutiny and the evidence thus obtained to exclusionary rule limitations if a constitutional violation is found.”).

224. For example, depending on the jurisdiction, law enforcement may be under no obligation to advise an individual of the use of recording devices and the like. See Carol M. Bast, *Privacy, Eavesdropping, and Wiretapping Across the United States: Reasonable Expectation of Privacy and Judicial Discretion*, 29 CATH. U. J.L. & TECH. 1, 30 (2020); see also, e.g., *State v. Paul*, 703 P.2d 1235 (Ariz. Ct. App. 1985).

225. 542 U.S. 177 (2004).

226. *Id.* at 181.

227. *Id.* at 191; see Taslitz, *supra* note 62, at 129–30. Of course, in *Hiibel*, the Court’s decision was premised on the notion that *Hiibel*’s duty to answer questions was founded in Nevada state stop-and-identify laws. See *Hiibel*, 542 U.S. at 187. Of note as well, *Hiibel* has been interpreted by some courts as permitting only *suspects* to be required to identify themselves, suggesting some basis in reasonable suspicion. See *Johnson v. Nocco*, 83 F.4th 896, 913 (11th Cir. 2023) (Wilson, J., dissenting).

228. See Joseph R. Ashby, Note, *Declining to State a Name in Consideration of the Fifth Amendment’s Self-Incrimination Clause and Law Enforcement Databases After Hiibel*, 104 MICH. L. REV. 779, 788–89 (2006) (arguing that stating one’s name can be testimonial under some circumstances).

unknowingly to reveal the secrets of his mind and body. With the use of ADLAIA technology, the audible expression of name, date of birth, or address also results in the provision of incriminating information from his mind and body. As noted in *Hiibel*, “acts of production may yield testimony establishing ‘the existence, authenticity, and custody of items [the police seek].’”²²⁹ The deceptive suggestion that answering these questions cannot lead to incriminating information, is what arguably fail constitutional muster.²³⁰ Though some amount of police deception has been overlooked in obtaining confessions, courts have drawn the line at fraud where it contradicts constitutional rights: “An officer cannot read the defendant his *Miranda* warnings and then turn around and tell him that despite those warnings, what the defendant tells the officer will be confidential and still use the resultant confession against the defendant.”²³¹ For this reason, “[i]n a number of cases, courts have deemed coerced statements that followed police assurances that their conversation was ‘off the record’ or ‘confidential.’”²³²

An analogy may well be drawn to the use of ADLAIA, particularly where an individual is unaware of its use. He may believe he is answering simple identification questions and has preserved his right to remain silent vis-à-vis anything more incriminating. Yet, unbeknownst to him, that very evidence is being gathered through his speech. Might that amount to sufficient deception to suppress his statements and the fruits therefrom? Before an individual may be subjected to the sort of testing encompassed by ADLAIA, should he be advised as to the potential information that his answers to any questions might reveal? The questions have yet to be answered.

The closest comparison may be, once again, brain scanning:

[R]esearchers at the University of Pennsylvania’s Institute for Strategic Analysis and Response claim to have developed techniques that allow them determine [sic] if a subject recognizes a picture of another human’s face. As with lying, certain regions of the brain “light up” on an fMRI scan when a subject sees a familiar human face. Seeing a familiar face stimulates brain activity in the hippocampus, which regulates memory and parts of the visual cortex. Thus, fMRI reveals recognition regardless of whether the

229. *Hiibel*, 542 U.S. at 189 (alteration in original) (quoting *United States v. Hubbell*, 530 U.S. 27, 41(2000)).

230. Dorothy Heyl, *The Limits of Deception: An End to the Use of Lies and Trickery in Custodial Interrogations to Elicit the “Truth”?*, 77 ALB. L. REV. 931, 948 (2014).

231. *Hopkins v. Cockrell*, 325 F.3d 579, 585 (5th Cir. 2003).

232. Michael J. Zydney Mannheimer, *Fraudulently Induced Confessions*, 96 NOTRE DAME L. REV. 799, 817–18 (2020).

individual speaks or attempts to conceal the recognition. It is, essentially, involuntary.²³³

As a result, refusal to speak does not defeat the purpose of the scanning. By assessing nonverbal memory activation in response to stimuli, the subject of this testing is given no choice.²³⁴ This implicates “[c]oncern over the state compromising an individual’s free will by forcing them to reveal things involuntarily,” a focus that “runs though all interrogation law.”²³⁵ While the difference with ADLAIA is that the individual is choosing to speak, courts draw a parallel, concluding that one’s voice is not voluntary under circumstances where he is uninformed about the use to which his voice will be put, permitting an “involuntary lie-detection test,”²³⁶ of sorts. Thus, voice analysis, like brain imaging techniques, may “deprive individuals of control over their thoughts,”²³⁷ thereby violating the “spirit and history of the Fifth Amendment.”²³⁸ This new technology demands revisiting issues such as voluntariness and consent.

C. Fourteenth Amendment: Procedural Due Process

The Fourteenth Amendment right to due process²³⁹ works in tandem with other provisions in the Constitution²⁴⁰ to guarantee criminal defendants notice and an opportunity to be heard—essentially a fundamentally fair trial process before deprivation of life, liberty, or property.²⁴¹ In *Mathews v. Eldridge*,²⁴² the U.S. Supreme Court announced a three-part procedural due process test designed to achieve accurate results in an efficient manner by balancing “the private interest” affected; the estimated “risk of an erroneous deprivation of such interest” combined with “the probable value . . . of

233. Sean Kevin Thompson, *A Brave New World of Interrogation Jurisprudence?*, 33 AM. J.L. & MED. 341, 345–46 (2007) (footnotes omitted).

234. *Id.* at 345–47.

235. *Id.* at 347.

236. Frederick Schauer, *Can Bad Science Be Good Evidence? Neuroscience, Lie Detection, and Beyond*, 95 CORNELL L. REV. 1191, 1203 (2010).

237. Dov Fox, *The Right to Silence as Protecting Mental Control*, 42 AKRON L. REV. 763, 801 (2009).

238. *Schmerber v. United States*, 384 U.S. 757, 764 (1986).

239. In relevant part, the Fourteenth Amendment to the U.S. Constitution provides:

No State shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States; nor shall any State deprive any person of life, liberty, or property, without due process of law; nor deny to any person within its jurisdiction the equal protection of the laws.

U.S. CONST. amend. XIV § 1.

240. Primarily the Sixth Amendment right to a fair trial (compulsory process and Confrontation Clause). U.S. CONST. amend. VI.

241. *Holmes v. South Carolina*, 547 U.S. 319, 324 (2006) (quoting *Crane v. Kentucky*, 476 U.S. 683, 690 (1986)).

242. 424 U.S. 319 (1976).

additional or substitute procedural safeguards”; and “the Government’s interest, including the function involved and the fiscal and administrative burdens that the additional or substitute procedural requirement would entail.”²⁴³ Where the worlds of law and science collide, one grievance sometimes lodged is the failure of procedural due process.²⁴⁴ Courts have “recognized that due process issues can arise when decisions are made by a software program.”²⁴⁵ The question then becomes, what process is due?

Broadly speaking, “a fair trial is one in which evidence subject to adversarial testing is presented to an impartial tribunal for resolution of issues defined in advance of the proceeding.”²⁴⁶ To adapt procedural due process to a situation in which artificial intelligence renders a decision that could result in deprivation of life, liberty, or property, an individual must be notified when he is placed at the mercy of such machine-related decisions.²⁴⁷ In general, a person is entitled to know of the claims against him: “The sufficiency of notice depends upon its ability to inform affected individuals about the issues to be decided, the evidence supporting the government’s position, and the agency’s decisional process.”²⁴⁸ That means that an individual is entitled to know, not just that he is subject to testing, but also how the results are reached—the processes involved in coming to conclusions that could affect his rights. Under this approach, notice would include disclosure of the type of predictions, as well as “the general sources of data that they draw upon as inputs, including a means whereby those whose personal data is included can learn of that fact.”²⁴⁹

The second prong to due process required an opportunity to be heard, which, in this context, permits one subjected to testing the opportunity to challenge the results.²⁵⁰ And, the right to be heard must be a meaningful one: “The right to present a complete defense encompasses the defendant’s ability

243. *Id.* at 335.

244. Aziz Z. Huq, *Constitutional Rights in the Machine-Learning State*, 105 CORNELL L. REV. 1875, 1905–06 (2020). For example, a typical DUI or DWUI conviction may result in fines, incarceration, and driver’s license suspension or revocation, all of which implicate due process interests. *See Bell v. Burson*, 402 U.S. 535, 539 (1971) (holding that a license suspension or revocation cannot occur without the “procedural due process required by the Fourteenth Amendment”).

245. *People v. H.K.*, 130 N.Y.S.3d 890, 897 (N.Y. Crim. Ct. 2020).

246. *Strickland v. Washington*, 466 U.S. 668, 685 (1984) (holding that the government violates right to effective assistance of counsel when it interferes with ability of counsel to make independent decisions about how to conduct defense).

247. Danielle Keats Citron, *Technological Due Process*, 85 WASH. U. L. REV. 1249, 1281–82 (2008).

248. *Id.* at 1282.

249. Kate Crawford & Jason Schultz, *Big Data and Due Process: Toward a Framework to Redress Predictive Privacy Harms*, 55 B.C. L. REV. 93, 125 (2014).

250. *Id.* at 126.

to meaningfully test the prosecution's evidence and to present favorable evidence in turn,"²⁵¹ which would include examining the evidence used, "both the data input and the algorithmic logic applied."²⁵² In this manner, the individual and even the public would have the opportunity to analyze the process, to "test" the results, and to correct the record. Only by permitting discovery into the methodology can flaws, corruption, and bias in the "machine" be addressed.²⁵³

By way of example, in *State v. Loomis*,²⁵⁴ a criminal defendant challenged the trial court's use of a risk assessment algorithm, known as "COMPAS," to determine his sentence. Although not a machine-based algorithm, the arguments are the same: "[T]he defendant argued that his due process rights were effectively violated by the trial court because of 'the proprietary nature' of the algorithm on which the trial court had relied."²⁵⁵ In response to the developer's contention that the proprietary nature of the algorithm rendered it a confidential trade secret, Mr. Loomis argued that this secrecy "denied [him] information which the [trial] court considered at sentencing," constituting a violation of his rights to procedural due process.²⁵⁶ The court ultimately rejected his claims, but similar issues have been raised more recently, with different results in criminal²⁵⁷ and civil arenas.²⁵⁸

The ability to challenge the results, and the methodology, is particularly important in the context of artificial intelligence, where humans tend to presume its accuracy and trust its results:

With or without a warning label, judges consistently give technology and forensic-based evidence heavier weight than other

251. Christian Chessman, *A "Source" of Error: Computer Code, Criminal Defendants, and the Constitution*, 105 CALIF. L. REV. 179, 200 (2017).

252. Crawford & Schultz, *supra* note 249, at 127.

253. Margot E. Kaminski & Jennifer M. Urban, *The Right to Contest AI*, 121 COLUM. L. REV. 1957, 1973 (2021) ("Contestation is a core mechanism for establishing and preserving justice in the Western adversarial tradition.").

254. 881 N.W.2d 749 (Wis. 2016).

255. Cary Coglianese & David Lehr, *Transparency and Algorithmic Governance*, 71 ADMIN. L. REV. 1, 33–34 (2019).

256. *Loomis*, 881 N.W.2d at 761.

257. *State v. Gordon*, 919 N.W.2d 635 (Iowa Ct. App.) (unpublished table decision) ("Nothing in our record indicates the existence of validation studies for these tests or any cross validation for an Iowa population of offenders. Without those assurances, we cannot be confident the sentencing court's reference to Gordon's risk level scores was anything but an 'off-label' use of these risk assessment instruments."), *vacated*, 921 N.W.2d 19 (Iowa 2018).

258. See *K.W. v. Armstrong*, 180 F. Supp. 3d 703, 718 (D. Idaho 2016) (holding that a proprietary tool used to allocate Medicaid benefits "arbitrarily deprives participants of their property rights and hence violates due process"); *T. v. Bowling*, No. 2:15-cv-09655, 2016 WL 4870284, at *10, *15 (S.D.W. Va. Sept. 13, 2016) (finding that a proprietary algorithm used by government to set Medicaid benefits "present[s] a serious risk of resulting in erroneous determinations and deprivations").

factors, whether the judges giving such weight realize that they are doing so or not. Studies have shown that people have “automation bias” and, therefore, place their trust in computer-generated assessments even when faced with evidence of the systems’ inaccuracies.²⁵⁹

Though the historical ideal was that machines would be neutral decision makers,²⁶⁰ time has shown otherwise. “Algorithms are created, not discovered. As human constructs, algorithms are susceptible to manipulation.”²⁶¹ The rules that make up an algorithm can be manipulated, intentionally or unintentionally, to reach skewed results.²⁶² Algorithms “can operate in a discriminatory and inconsistent fashion”; they “can rely on skewed databases”; they “reflect the programmer’s own biases in their design”; and they sometimes “operate in unpredictable ways.”²⁶³ One of the greatest concerns lies with the disparate impact of flawed algorithmic testing, which is “only as free from bias as the software and data behind [it].”²⁶⁴

If one of the accepted goals of due process is to strengthen public confidence in the legal system, open, honest, and full disclosure about the functioning of algorithms upon which some legal decisions depend promotes that goal.²⁶⁵ Where a process cannot be fully understood and challenged by those subjected to its results, secrecy generates distrust and, more importantly, fosters a system in which errors can lead to convictions.²⁶⁶ Where an individual may be convicted of a crime based upon audio-based deep-learning algorithms utilized to detect his level of alcohol intoxication, he would be well advised to seek disclosure of details about the algorithm, the testing, the process, and the science behind this evidence to assess any errors that could have been resolved by human attention.²⁶⁷ Unfortunately, the “public usually has no access to the steps, procedures, and other content

259. Katherine Freeman, *Algorithmic Injustice: How the Wisconsin Supreme Court Failed to Protect Due Process Rights in State v. Loomis*, 18 N.C. J.L. & TECH. 75, 97–98 (2016).

260. Lilian Edwards & Michael Veale, *Slave to the Algorithm? Why A ‘Right to an Explanation’ Is Probably Not the Remedy You Are Looking For*, 16 DUKE L. & TECH. REV., 18, 27 (2017).

261. Philip M. Nichols, *Bribing the Machine: Protecting the Integrity of Algorithms as the Revolution Begins*, 56 AM. BUS. L.J. 771, 789 (2019).

262. *Id.*

263. Orna Rabinovich-Einy & Ethan Katsh, *The New New Courts*, 67 AM. U. L. REV. 165, 210–11 (2017).

264. Danielle Keats Citron & Frank Pasquale, *The Scored Society: Due Process for Automated Predictions*, 89 WASH. L. REV. 1, 13–14 (2014).

265. Doaa Abu-Elyounes, *Contextual Fairness: A Legal and Policy Analysis of Algorithmic Fairness*, U. ILL. J.L. TECH. & POL’Y, Spring 2020, at 1, 33.

266. Citron & Pasquale, *supra* note 264, at 12 (discussing arbitrary assessments in credit scoring).

267. This is not to say that humans are “better” than machines. *See* Huq, *supra* note 244, at 1909–10. Rather, scholars and scientists have routinely concluded that “structured decision making” is better than humans acting alone, or even human oversight of algorithmic decisions. *See id.*

in algorithms used to enable machines to make decisions that affect general well-being.”²⁶⁸ It is in this reality that due process is lagging.

While the importance of the confidentiality of proprietary information is a respectable argument, it pales in comparison to individual due process rights. Accordingly, principles of due process may support disclosure of such (proprietary) information on several due process grounds²⁶⁹: First, due process is concerned with evidence “material either to guilt or to punishment.”²⁷⁰ So, if evidence regarding the science²⁷¹ behind technology is withheld from a defendant and a conviction results, a fair inquiry is “whether in its absence [the defendant] received a fair trial, understood as a trial resulting in a verdict worthy of confidence.”²⁷² Before the machine is permitted to make decisions that impact the lives of humans, its accuracy should be subjected to scrutiny. The transparency afforded with disclosure of the inputs and processes behind ADLAIA and similar technology creates accountability and reduces “asymmetries of information.”²⁷³ This approach would also comport with several of the underlying values of due process: accuracy of the determination appearance of fairness; predictability, transparency, and rationality; participation; and revelation.²⁷⁴

Finally, the notions of fairness that lie behind procedural due process guarantees could be achieved by subjecting AI, with its inherent flaws, to the scrutiny of a neutral human adjudicator.²⁷⁵ Whether judge or jury, this human arbiter would be tasked with ensuring “greater fairness with predictive

268. Nichols, *supra* note 261, at 805–06.

269. Brief of Amici Curiae American Civil Liberties Union and American Civil Liberties Union of Southern California in Support of Defendant-Appellant Seeking Reversal at 26, *People v. Johnson*, No. F071640, 2019 WL 3025299 (Cal. Ct. App. July 11, 2019) [hereinafter *Johnson* Brief]; see also Meghan J. Ryan, *Secret Conviction Programs*, 77 WASH. & LEE L. REV. 269, 274–75 (2020).

270. *Brady v. Maryland*, 373 U.S. 83, 87 (1963).

271. “Science,” here, is meant to encompass the algorithms and underlying inputs that allow ADLAIA to “do its job.” It is not uncommon for such potentially protected information to be shielded from disclosure and public view. See, e.g., *Yun Zhou v. Hao Zhang*, No. FA134026445, 2016 WL 8115542, at *2 (Conn. Super. Ct. Oct. 18, 2016) (entering protective order regarding, among other things, “information and records concerning proprietary business information, programs, strategies, methodologies, technologies, formulas, algorithms, computer technology, programs, proprietary business information, trade secrets”); see also Chessman, *supra* note 251, at 205 (“[T]he inquiry into whether insulating computerized evidence from adversarial testing violates the right to present a complete defense turns on the nature and persuasiveness of the rationale for denying a defendant access to source code and the significance of the evidence to the defense.”); Andrea Roth, *Trial by Machine*, 104 GEO. L.J. 1245, 1272 (2016) (discussing the difficulty of obtaining machine source codes to breathalyzers); Natalie Ram, *Innovating Criminal Justice*, 112 NW. U. L. REV. 659, 663 (2018) (discussing the problem of secrecy in criminal justice algorithms).

272. *Kyles v. Whitley*, 514 U.S. 419, 434 (1995).

273. Nichols, *supra* note 261, at 806–07.

274. Crawford & Schultz, *supra* note 249, at 119.

275. *Id.* at 127.

analytics.”²⁷⁶ Understandably, this concern arises from accounts of accusations and convictions made with blind reliance on the accuracy of machines: “The implication is that machines are prone to error and that a hearing of sorts before a human adjudicator is a necessary adjustment to any algorithmically driven process.”²⁷⁷ Where an individual has a right to a “hearing,” it seems implied that the hearing occur before “a natural person who is either physically present for verbal arguments, or who reads and evaluates written submissions.”²⁷⁸ Humans play a role in scrutinizing science and determining that admitted evidence is sufficiently reliable.²⁷⁹ For example, in the DNA field, “[b]oth the initial recognition of serious problems and the subsequent development of reliable procedures were aided by the existence of a robust community of molecular biologists’ and by ‘judges who recognized that this powerful forensic method should only be admitted as courtroom evidence once its reliability was properly established.’”²⁸⁰ The same may hold true for audio-based deep-learning algorithms to identify alcohol inebriation. In this way, by funneling technological advances through human inquiry and common sense, society is most assured of impartial decisionmaking based on “accurate evidence and relevant legal rules.”²⁸¹ In *Goldberg v. Kelly*,²⁸² the Supreme Court opined, “[t]o demonstrate compliance with this elementary requirement, the decision maker should state the reasons for his determination and indicate the evidence he relied on.”²⁸³ For evidence obtained through ADLAI, if the neutral arbiter is exposed to the information about the testing that allows him to adjudge its accuracy, then the “elementary requirements” of procedural due process have been met.

276. *Id.*

277. Huq, *supra* note 244, at 1906.

278. Aziz Z. Huq, *A Right to A Human Decision*, 106 VA. L. REV. 611, 626 (2020).

279. See *Johnson* Brief, *supra* note 269, at 33–34 (collecting sources); see, e.g., Han Tak Lee v. Houtzdale SCI, 798 F.3d 159, 166–67 (3d Cir. 2015) (discussing changes in “fire science”); *People v. Leone*, 255 N.E.2d 696 (N.Y. 1969) (relying expert testimony to conclude that that polygraph tests evidence was not admissible); *People v. Davis*, 72 N.W.2d 269, 281 (Mich. 1965) (same).

280. *Johnson* Brief, *supra* note 269, at 34 (quoting PRESIDENT’S COUNS. OF ADVISORS ON SCI. & TECH. (PCAST), EXEC. OFF. OF THE PRESIDENT, FORENSIC SCIENCE IN CRIMINAL COURTS: ENSURING SCIENTIFIC VALIDITY OF FEATURE-COMPARISON METHODS 26, 29 (2016)).

281. Coglianese & Lehr, *supra* note 255, at 23; see Rebecca Crootof, Margot E. Kaminski & W. Nicholson Price II, *Humans in the Loop*, 76 VAND. L. REV. 429, 440–41 (2023) (“Human-in-the-loop systems may take a variety of forms. They include ones where an individual human decisionmaker has the discretion to use an algorithmic system to reach a particular decision in a particular instance . . .”).

282. 397 U.S. 254 (1970).

283. *Id.* at 271.

D. Fourteenth Amendment: Equal Protection

Equal protection notions of the Fifth and Fourteenth Amendments also might be implicated by the use of audio-based deep-learning algorithms to identify alcohol inebriation. The Equal Protection Clause, located in the Fourteenth Amendment, provides: “No state shall . . . deny to any person within its jurisdiction the equal protection of the laws.”²⁸⁴ The Clause “protects individuals from unequal laws or unequal applications of the law that stem from illegitimate government purposes or means.”²⁸⁵

The fact of the matter is that, currently, algorithms result in unequal treatment. Significant differences exist between the performance of biometric systems on subgroups, thereby privileging some and disadvantaging others.²⁸⁶ Of course, these discrepancies are not unique to ADLAIA.²⁸⁷ For other technology reliant on machine learning algorithms, such as Apple’s Siri, Amazon’s Alexa, Google Assistant, and Microsoft’s Cortana, accuracy at analyzing voices, faces, and other biometric data depends upon characteristics such as gender, race, ability, national origin, primary language, age, and so on.²⁸⁸ For example, exploring racial and gender disparities in voice biometrics, females performed better than males, Latinx speakers performed worse than White or Black speakers.²⁸⁹ Similar findings have been made in the field of automated facial analysis algorithms and data sets where gender and skin type were taken into account.²⁹⁰

In the context of ADLAIA, decisions about inebriation are made from voice characteristics such as pitch, volume, speed, tone, not on the basis of gender or race. However, for example, where ADLAIA’s input sample size focused primarily upon “native” speakers (from the German Alcohol Language Corpus Dataset),²⁹¹ the system’s unintentional inherent bias likely

284. U.S. CONST. amend. XIV, § 1. The Supreme Court has held that equal protection applies to the federal government through the Due Process Clause of the Fifth Amendment on the rationale that the Fifth Amendment includes an implicit requirement for equal protection. *See Bolling v. Sharpe*, 347 U.S. 497 (1954).

285. Robert S. Logan, Note, *The Reverse Equal Protection Analysis: A New Methodology for “Special Needs” Cases*, 68 GEO. WASH. L. REV. 447, 462 (2000).

286. Xingyu Chen et al., *Exploring Racial and Gender Disparities in Voice Biometrics*, 12 SCI. REPS. 3723 (2022).

287. Joy Buolamwini & Timnit Gebru, *Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification*, 81 PROC. MACHINE LEARNING RSCH. 1 (2018), <https://proceedings.mlr.press/v81/buolamwini18a/buolamwini18a.pdf> (discussing race- and gender-based discrimination in machine learning algorithms).

288. Bajorek, *supra* note 47; Claudia Lopez Lloreda, *Speech Recognition Tech Is Yet Another Example of Bias*, SCI. AM. (July 5, 2020), <https://www.scientificamerican.com/article/speech-recognition-tech-is-yet-another-example-of-bias/>.

289. Chen et al., *supra* note 286.

290. Buolamwini & Gebru, *supra* note 287, at 1.

291. Bonela et al., *supra* note 4, at 50.

results in disparate results for non-native speakers,²⁹² with the potential to lead to increased incidents of investigation, arrest, and conviction for those individuals. More significantly, voice biometric systems display racial and gender disparities.²⁹³ Thus, algorithmic errors and unintentional biases may result in erroneous intoxication determinations of persons belonging to historically underrepresented groups, leading to those individuals being wrongfully targeted for investigation, arrest, and conviction.²⁹⁴ It takes no stretch of the imagination to conclude that these systems result in disparate treatment and have a disparate impact. Under such scenarios, algorithmic analysis is anything but equal in terms of its risk to historically underrepresented groups.²⁹⁵ Should such technology not (when in the hands of the government) fail an equal protection challenge for treating people unequally?²⁹⁶

Indeed, equal protection laws also apply to classifications that are “ostensibly neutral but [are] an obvious pretext for racial discrimination.”²⁹⁷ But, while an individual asserting an equal protection challenge may readily point to well-established categorical inaccuracy rates of the particular system to establish that the system caused discriminatory impact, a successful challenge requires more.²⁹⁸ Under those circumstances, “even if a neutral law has a disproportionately adverse effect upon a racial minority, it is unconstitutional under the Equal Protection Clause only if that impact can be traced to a discriminatory purpose [or intent].”²⁹⁹ In the context of gender discrimination, the Court has explained, “[t]he first question is whether the statutory classification is indeed neutral in the sense that it is not gender-based.”³⁰⁰ When the classification is not based overtly or covertly on gender, “the second question is whether the adverse effect reflects invidious gender-based discrimination.”³⁰¹ For this second prong, “impact provides an

292. Kröger et al., *supra* note 76, at 247.

293. Chen et al., *supra* note 286.

294. SANTAMARIA, *supra* note 24, at 18–19.

295. Christopher Thomas & Antonio Pontón-Núñez, *Automating Judicial Discretion: How Algorithmic Risk Assessments in Pretrial Adjudications Violate Equal Protection Rights on the Basis of Race*, 40 MINN. J.L. & INEQ. 371, 395 (2022) (“There is ample evidence that many algorithmic [risk assessment tools] used in criminal adjudications impact defendants differently based on their race or ethnicity.”).

296. Of course, the Equal Protection Clause does not prohibit all classifications, nor does it require that a law affects all groups evenly. Rather, “[w]hen the basic classification is rationally based, uneven effects upon particular groups within a class are ordinarily of no constitutional concern.” Scott E. Rosenow, *Heightened Equal-Protection Scrutiny Applies to the Disparate-Impact Doctrine*, 20 TEX. J. C.L. & C.R. 163, 169–70 (2015).

297. *Pers. Adm’r of Mass. v. Feeney*, 442 U.S. 256, 271–72 (1979).

298. See SANTAMARIA, *supra* note 24, at 25.

299. *Feeney*, 442 U.S. at 272; see *Washington v. Davis*, 426 U.S. 229 (1976).

300. *Feeney*, 442 U.S. at 274.

301. *Id.*

‘important starting point,’ but purposeful discrimination is ‘the condition that offends the Constitution.’”³⁰²

As a result, the nuance behind an equal protection challenge lies in “conceptions of intent.”³⁰³ Here, no one has suggested that ADLAIA *intends* to discriminate on any basis other than (intoxicated) voice.³⁰⁴ There is no suggestion of unconstitutional animus, even if the results necessarily offend one’s sense of justice.³⁰⁵ But what if a government agency is aware of the discriminatory consequences of a system (e.g., the disparate efficacy and impact of ADLAIA), yet *persists* in using the technology. Should the government be permitted to continue to use a system even once it is aware of the discriminatory consequences of the system? As to this situation, the Supreme Court has opined, “[d]iscriminatory purpose,’ however, implies more than intent as volition or intent as awareness of consequences. It implies that the decisionmaker . . . selected or reaffirmed a particular course of action at least in part ‘because of,’ not merely ‘in spite of,’ its adverse effects upon an identifiable group.”³⁰⁶

Accordingly, an ADLAIA challenger would need to show, not only that the government was aware that the technology might be more likely to misidentify persons of a particular group, but also that the government intended to use ADLAIA *because of* “its adverse effects upon an identifiable group.”³⁰⁷ As intended, ADLAIA distinguishes (and leads to decisions) based on voice characteristics, regardless of race, gender, age, nationality, or any other class (other than inebriation). Again, a challenge to the this usage seems unlikely to succeed. Thus, the current state of constitutional law likely provides leeway for the use of ADLAIA technology even if, and when, it

302. *Id.* (first quoting *Arlington Heights v. Metro. Dev. Corp.*, 429 U.S. 252, 266 (1977); and then quoting *Swann v. Charlotte-Mecklenburg Bd. of Educ.*, 402 U.S. 1, 16 (1971)).

303. Note, *Beyond Intent: Establishing Discriminatory Purpose in Algorithmic Risk Assessment*, 134 HARV. L. REV. 1760, 1760 (2021).

304. Of course, one exception to this premise would lie where an algorithm’s designer was motivated by either animosity toward a racial group or a prior belief that race correlates with criminality, and then deliberately design the algorithm on that basis. Such a scenarios is conceivable, though unlikely, but proving it, absent direct evidence of discriminatory intent would be nearly impossible. It would, “moreover, be especially difficult to show that, but for race, a specific feature would or would not have been included, as the doctrine requires.” Aziz Z. Huq, *Racial Equity in Algorithmic Criminal Justice*, 68 DUKE L.J. 1043, 1090 (2019).

305. See Thomas & Pontón-Núñez, *supra* note 295, at 394. Thus, for example, an official’s mere awareness of race raises no constitutional problem and disparate impact alone is insufficient to establish an equal protection violation. This is because “[r]ace as a feature is constitutionally problematic only if it influences ultimate decisions in a constitutionally relevant way.” Huq, *supra* note 244, at 1920.

306. *Feeney*, 442 U.S. at 279 (citing *United Jewish Orgs. v. Carey*, 430 U.S. 144, 179 (1977) (Brennan, J., concurring)).

307. *Id.*; see SANTAMARIA, *supra* note 24, at 26–27.

unwittingly (and unintentionally) results in disparate detection of intoxication.

E. Confrontation Clause

Next, one must ask whether, and to what extent, a criminal conviction (or comparable negative consequences) that is at least somewhat reliant on the machine-based decisions of deep-learning algorithms such as ADLAIA violates a defendant's rights to confront "the witnesses against him" under the Confrontation Clause.³⁰⁸ The Confrontation Clause of the Sixth Amendment provides that "[i]n all criminal prosecutions, the accused shall enjoy the right . . . to be confronted with the witnesses against him."³⁰⁹ The Supreme Court has clarified that this requirement applies to witnesses' "testimonial statements," which may not be admitted unless the defendant has some opportunity for cross-examination.³¹⁰

The Court has explicitly defined "testimonial," to include lab testing and results. In *Melendez-Diaz v. Massachusetts*,³¹¹ during a criminal drug trial, the prosecution presented affidavits reporting the results of forensic laboratory analysis that showed the substance seized from the defendant was cocaine.³¹² The Court found the lab results to be testimonial statements requiring confrontation of the lab analysts.³¹³ Similarly, in *Bullcoming v. New Mexico*,³¹⁴ the prosecution presented a blood alcohol report analyzing the defendant's blood alcohol content. The Court found that the report qualified as testimonial and required the specific analyst whose testimony was incorporated in the report to testify, rather than a substitute who merely was "familiar with the laboratory's testing procedures, but had neither participated in nor observed the test on [the defendant]'s blood sample."³¹⁵ The Court clarified that "[a] document created solely for an 'evidentiary purpose' . . . made in aid of a police investigation, ranks as testimonial" such that the person who conducted the test (and not a substitute) must testify as to its results.³¹⁶

308. U.S. CONST. amend. VI; see Meghan J. Ryan, *Secret Algorithms, IP Rights, and the Public Interest*, 21 NEV. L.J. 61, 91 (2020).

309. U.S. CONST. amend. VI.

310. *Crawford v. Washington*, 541 U.S. 36, 59, 68 (2004) ("Testimonial statements of witnesses absent from trial [can be] admitted only where the declarant is unavailable, and only where the defendant has had a prior opportunity to cross-examine.").

311. 557 U.S. 305 (2009).

312. *Id.* at 307.

313. *Id.* at 308.

314. 564 U.S. 647 (2011).

315. *Id.* at 651.

316. *Id.* at 664; see Chad Squitieri, Note *Confronting Big Data: Applying the Confrontation Clause to Government Data Collection*, 101 VA. L. REV. 2011, 2022 (2015).

Thus, in the comparable context of ADLAIA, questions arise as to the rights of those subjected to its testing to confront the “tester.”³¹⁷ Certainly these non-human components of the algorithm provide support for accusations against the individual, arguably the most compelling support. Under those circumstances, the algorithm might serve as the “key witness” against the defendant by providing the equivalent of testimony as to his level of intoxication. When these algorithms are used as evidence against a defendant, but the defendant lacks “the ability to cross-examine anyone about the programs’ intricacies,” the Sixth Amendment may be implicated.³¹⁸ As has been summarized:

First, if substituted for the testimony of witnesses otherwise subject to credibility testing, machine testimony allows the State to evade responsibility for accusations. Second, the State’s ability to shape and shield testimony from scrutiny through proprietary black box algorithms is analogous to the *ex parte* affidavit practice that preoccupied the Framers. Third, machines are potentially unreliable when their processes are shrouded in a black box. While machines generally cannot be physically confronted, they can be impeached in other ways, and courts and scholars should revisit cases in which the Supreme Court appears to recognize implicitly that “confrontation” includes a right of meaningful impeachment.³¹⁹

Such an argument was made in *People v. Wakefield*,³²⁰ in a murder and robbery case that relied on DNA test results. Law enforcement located DNA on incriminating evidence involved in the murder and used a buccal swab from the defendant to compare his DNA to the DNA collected at the scene using a software program known as TrueAllele Casework System.³²¹ On appeal, the defendant argued that his Confrontation Clause rights were violated because he was denied access to TrueAllele’s source code.³²² The appellate court agreed with the defendant that the TrueAllele report was testimonial but rejected the argument that the source code should be made available to him, noting that the creator of TrueAllele appeared in court and testified at length about the algorithm and underlying genetic science.³²³ The court stated:

317. See Jessica Gabel Cino et al., *The Oracle Testifies: Facial Recognition Technology as Evidence in Criminal Courtrooms*, 61 U. LOUISVILLE L. REV. 137, 144–45 (2023).

318. Meghan J. Ryan, *Criminal Justice Secrets*, 59 AM. CRIM. L. REV. 1541, 1589 (2022).

319. Andrea Roth, *Machine Testimony*, 126 YALE L.J. 1972, 1983 (2017).

320. 195 N.E.3d 19 (N.Y. 2022).

321. *Id.* at 491.

322. *Id.* at 494.

323. *Id.* at 497; see Steven M. Bellovin et al., *Seeking the Source: Criminal Defendants’ Constitutional Right to Source Code*, 17 OHIO ST. TECH. L.J. 1, 60–61 (2021). As Bellovin et al.

Despite concluding that the TrueAllele report is testimonial, we do not find, given the particular facts of this case, that the source code, even through the medium of the computer, is a declarant. This is not to say that an artificial intelligence-type system could never be a declarant, nor is there little doubt that the report and likelihood ratios at issue were derived through distributed cognition between technology and humans. Indeed, similar to many expert reports, the testimonial aspects of the TrueAllele report are formulated through a synergy and distributed cognition continuum between human and machine, but this fact alone does not tip the scale so far as to transform the source code into a declarant.³²⁴

Importantly, in *Wakefield*, the Court recognized that machine learning is not autonomous;³²⁵ thus, an argument can be made that “[t]he fact that a harmed person has no evidentiary mechanisms to question algorithmic accusers violates the intent of the Sixth Amendment’s Confrontation Clause.”³²⁶ In the context of ADLAIA, such evidence necessarily includes statements of a scientist or technician who conducts the analysis (the test results) that is offered for its truth (the level of intoxication).

However, this raises further question: “Is the person to cross-examine the architect of the algorithm or is scrutiny simply applied to the algorithm itself? There are also relevant considerations about how this process is likely further complicated by the present opacity of proprietary technology.”³²⁷ To be sure, “a machine cannot be cross-examined”;³²⁸ however, questioning the scientist may be insufficient.³²⁹ For example, “[e]ven if a forensic scientist conducts a probabilistic genotyping system test on a DNA sample and the defense has the opportunity to cross-examine the forensic scientist about the report, because the forensic scientist has little to no knowledge about how the probabilistic genotyping system functions, this cross-examination may not be very useful to the defense.”³³⁰ Similarly, to comply with the Confrontation Clause, adversarial testing of ADLAIA and similar voice analysis algorithms may require meaningful “access to materials necessary to test the reliability

explain, “[h]aving the algorithm’s designer testify about the code did not answer, however, whether the software performed correctly; only an examination of the code could do that.” *Id.*

324. *Wakefield*, 107 N.Y.S.3d at 497 (2019) (citations omitted).

325. *See id.*; Emma Lux, Note, *Facing the Future: Facial Recognition Technology Under the Confrontation Clause*, 57 AM. CRIM. L. REV. ONLINE 20, 31 (2020).

326. Sonia M. Gipson Rankin, Technological Tethereds: *Potential Impact of Untrustworthy Artificial Intelligence in Criminal Justice Risk Assessment Instruments*, 78 WASH. & LEE L. REV. 647, 707 (2021).

327. Cino et al., *supra* note 317, at 145.

328. *See People v. Lopez*, 286 P.3d 469, 478 (Cal. 2012).

329. Roth, *supra* note 271, at 1301.

330. Ryan, *supra* note 308, at 91 (2020).

of algorithms,” including “access to algorithmic source codes, input data and/or the scientist(s) who invented, assembled, or built it.”³³¹

F. Right to Privacy

The right to privacy is not explicit in the United States Constitution. Rather, “it is ‘complex . . . entangled in competing and contradictory dimensions, [and] engorged with various and distinct meanings.’”³³² Privacy is important to autonomy and personal identity,³³³ encompassing the ability to decide when, how, and to whom personal information is disclosed.³³⁴ As may be expected, the right has seeped into other areas of constitutional law, such as the privilege against self-incrimination³³⁵ and the right against unreasonable searches and seizures.³³⁶ Borrowing from the Fourth Amendment, a central function of recognized rights is to “protect personal privacy and dignity against unwarranted intrusion by the State.”³³⁷ In the context of ADLAIA, the privacy concerns are two-fold: (a) the privacy rights of those subjected to ADLAIA testing to detect intoxication and (b) the privacy rights of those who contributed to the creation of the algorithm that created ADLAIA.

1. Privacy Rights of Those Subjected to ADLAIA Testing

First, with respect to those subjected to ADLAIA testing, the concern is whether that individual’s privacy rights are, first, implicated and, second, violated. The Supreme Court has been willing to recognize an individual privacy right against the State’s improper collection, aggregation, or disclosure of an individual’s private information.³³⁸ The Court even has gone so far as to recognize the right against government acquisition of private information held by third parties.³³⁹

331. Roth, *supra* note 271, at 1301; *see also* Elizabeth A. Rowe & Nyja Prior, *Procuring Algorithmic Transparency*, 74 Ala. L. Rev. 303, 333 (2022) (“[W]hether the confrontation right applies to algorithms and outside of a trial . . . is a very complex issue.”); Katherine Kwong, *The Algorithm Says You Did It: The Use of Black Box Algorithms to Analyze Complex DNA Evidence*, 31 HARV. J.L. & TECH. 275, 300–01 (2017) (arguing that courts “should also consider adopting a rule barring the results of algorithmic analysis of complex mixtures unless the source code and built-in assumptions behind the algorithmic process are disclosed to defense teams”).

332. Huq, *supra* note 244, at 1927 (alterations in original) (quoting Robert C. Post, *Three Concepts of Privacy*, 89 GEO. L.J. 2087, 2087 (2001)).

333. Kitai-Sangero, *supra* note 108, at 298.

334. Huq, *supra* note 244, at 1927.

335. Kitai-Sangero, *supra* note 108, at 298.

336. Connor, *supra* note 152, at 378.

337. *Schmerber v. California*, 384 U.S. 757, 767 (1966); *see* Connor, *supra* note 152, at 378.

338. *Whalen v. Roe*, 429 U.S. 589, 599–600 (1977).

339. *Carpenter v. United States*, 138 S. Ct. 2206, 2219–20 (2018).

Of note, however, is the continuing complication of the public availability of the data.³⁴⁰ As discussed previously, “[t]he U.S. Supreme Court has long held that there is no reasonable expectation of privacy in ‘what a person knowingly exposes to the public.’”³⁴¹ Thus, presence in a public location often negates the claim to a violation of privacy rights under the Fourth Amendment,³⁴² and “[s]imilar reasoning has been applied by federal and state courts to allow the publication of information or images gathered in public.”³⁴³ The notion that one has no right to be left alone in public “has precluded invasion of privacy claims based on the publication of information or images posted on social media, disclosed in a police report, filmed at public events or in public view, or filmed in full view of the public.”³⁴⁴ Even in the face of an argument that the plaintiff intended to be seen only by certain individuals, courts have declined to extend privacy rights to those whose images and likenesses were captured.³⁴⁵

The uniqueness of the privacy debate vis-à-vis technological developments, like ADLAIA, is the *degree* to which those developments result in the individual’s loss of control over disclosure of his private information. As one scholar explains:

[O]ne’s ability to control the access that others have to him/her is a fundamental human interest, and that privacy rights are the guardian of that interest. This theory holds that people need a certain dominion over when and whether they will interact with others, and that secrecy, anonymity, and solitude are the tools with which we exercise that dominion.³⁴⁶

Modern surveillance necessarily results in greater loss of that control,³⁴⁷ both in terms of the size of the audience and the extent of the information to be disclosed. Thus, the argument over privacy protection is developing in light of a variety of technological advancements that broaden the power to collect arguably private data.³⁴⁸ For example, there are ongoing debates regarding the use of drones, with privacy advocates calling for limitations on drone images and data where they contained “unique biometric data, such as imagery of an individual’s face and voice recordings, that are linked or easily

340. Christine N. Walz & Daniel S. Brookins, *Privacy in Public? A Look at Recent Efforts to Recognize Privacy Protections in Public Spaces*, 32 COMM’NS LAW. 24 (2016).

341. *Id.* (quoting *Katz v. United States*, 389 U.S. 347, 351 (1967)).

342. Fretty, *supra* note 106, at 438.

343. Walz & Brookins, *supra* note 340, at 24.

344. *Id.* (footnotes omitted) (collecting cases).

345. *Four Navy Seals v. Associated Press*, 413 F. Supp. 2d 1136, 1145 (S.D. Cal. 2005).

346. Fretty, *supra* note 106, at 438 (footnote omitted).

347. *Id.* at 438–39.

348. Walz & Brookins, *supra* note 340, at 24–25.

linkable to an identifiable person.”³⁴⁹ Scholars and advocates have also discussed the appropriateness of disclosing police body camera footage, which “capture incidents up-close, in real time” and have “data subjects [who] are often people in the midst of traumatic circumstances or embarrassing situations.”³⁵⁰

Voice monitoring and analysis call for even greater concern, as they risk involuntarily exposing much more than one’s voice. ADLAIA has the potential to reveal the sound of an individual’s voice, the content of his speech and the meaning behind the words, the state of his mental and physical being, and other personal and historical information. While the sound of an individual’s voice and the content of his speech are arguably publicly available, it is a stretch to extend that notion to include the algorithmic analysis of his voice and all that it reveals.

Moreover, access to ADLAIA’s information may be available for government use (and abuse) regardless of whether the data originated in public or private hands. By analogy, police already have used recordings by Echo devices to solve crimes.³⁵¹ In one murder investigation where the prosecution sought recordings, “Amazon initially resisted sharing the data, arguing that the data is speech protected by the First Amendment, but eventually shared it after [the defendant] agreed to release the data.”³⁵² In another murder case, “a New Hampshire judge ordered Amazon to hand over the Echo recordings from a suspected murder scene after a woman was stabbed to death in her kitchen.”³⁵³ Amazon’s current privacy policy states: “Amazon does not disclose customer information in response to government demands unless we’re required to do so to comply with a legally valid and binding order. Amazon objects to overbroad or otherwise inappropriate demands as a matter of course.”³⁵⁴ However, as one scholar points out, “[w]ithout further illumination from the courts, the privacy of smart device data relies on the internal policies of the businesses which collect that data, and a subpoena will be enough compulsion for most businesses to cooperate.”³⁵⁵

349. See CTR. FOR DEMOCRACY & TECH., MODEL PRIVACY BEST PRACTICES FOR UNMANNED AIRCRAFT 3 (2015), <https://cdt.org/insight/model-privacy-best-practices-for-unmanned-aircraft/>.

350. Walz & Brookins, *supra* note 340, at 26.

351. Bishop, *supra* note 114, at 692–93.

352. *Id.* at 692 (footnotes omitted). After they reviewed the audio and data from “a smart utility meter,” prosecutors dropped the case. *Id.*

353. *Id.* at 693.

354. Amazon Sidewalk Privacy and Security Whitepaper, AMAZON, <https://www.amazon.com/gp/help/customer/display.html?nodeId=GRGWE27XHZPRPBGX> (last visited Dec. 12, 2013).

355. Bishop, *supra* note 114, at 693.

In the civil arena, those with access to ADLAIA recordings may collect information about an individual and use that collected data in a variety of potentially harmful ways by using it for their own gain or selling it to third parties.³⁵⁶ The potential for abuse of private information has been suggested in a variety of contexts:

[E]mployers may use data obtained from workplace wellness programs and wearable technologies to run predictive analytics assessing employees' risk of future injury. Without the worker's knowledge or consent, employers could use these data not only to determine the worker's compensation but also to influence the employers' promotion, training, and termination decisions. An algorithm might flag an employee due to her weight or her addiction to cigarettes, without hindrance from federal law.³⁵⁷

Should the same concern not apply to ADLAIA results where, based on levels of intoxication, an employee might be flagged for mental health or substance abuse concerns? In the wrong hands, ADLAIA could collect data with respect to an individual's history and personal preferences; engage in discriminatory commercial practices; and be "mingled with data from other users, without clear consent."³⁵⁸ The distinction between public and private information has blurred with developments in science and technology. Thus, courts are grappling with the current state of privacy law and its application, modification, or extension to a world where artificial intelligence permits a broader and deeper look into private lives.

2. Privacy Rights of the "Voice Pool"

More creative is the argument that those speakers who participated in creating the original source "pool" of voices also have privacy rights that they

356. Noga Blickstein Shchory & Michal S. Gal, *Voice Shoppers: From Information Gaps to Choice Gaps in Consumer Markets*, 88 BROOK. L. REV. 111, 153 (2022).

357. Eric Pedersen, *People Analytics and Individual Autonomy: Employing Predictive Algorithms as Omniscient Gatekeepers in the Digital Age Workplace*, 2020 COLUM. BUS. L. REV. 1122, 1153. The aftermath associated with facial recognition provides a grim analogy:

Catherine Bosley, a news anchor from Ohio, had suffered from several life-threatening ailments. After she underwent several surgeries and finally learned that she was going to live, she took a vacation with her husband to Florida. There, surrounded by strangers and possessed by the desire to do something exhilarating to celebrate her newfound life, she entered a "wet T-shirt" contest. As she described it, "[w]e thought it'd be our moment with a bunch of strangers." A year later, pictures and video from the contest were on the Internet and she was fired from her job. The station's rationale was simple: "Catherine is a seasoned veteran who consciously chose to engage in behavior that she knew was inconsistent with the responsibilities of her chosen profession."

Note, *In the Face of Danger: Facial Recognition and the Limits of Privacy Law*, 120 HARV. L. REV. 1870, 1875 (2007).

358. Shchory & Gal, *supra* note 356, at 158.

may wish to protect.³⁵⁹ By way of background and as discussed previously, an algorithm is created, and improved, by relying on input data (a source pool, so to speak) subjected to a computational process that provides output data.³⁶⁰ For ADLAIA specifically, this means that the technology relies upon audio recordings of speakers, sober and intoxicated, captured in the German Alcohol Language Corpus Dataset³⁶¹ to serve as the source of its knowledge about the impact of intoxication on voice. Deep-learning algorithms are applied to that source data to create a program ideally capable of recognizing intoxication when applied to new voices.³⁶² Done well, an algorithm can detect “subtle and insightful relationships between various data features.”³⁶³ And therein lies the problem:

That seemingly oracular ability to illustrate connections between otherwise random attributes is both what make big data so useful, and what leads to its piercing ability to reveal private information. It can elicit inferences an individual did not want to know, or might not want anyone else to know, such as a medical condition. It can also draw relationships between legally protected and unprotected categories, and base decisions off of those correlations. Even when the information is not legally protected or inherently sensitive, there are concerns that increasingly precise determinations could be used to create inscrutably complex portraits of consumers, in a way that could further diminish consumer control.³⁶⁴

Presumably, those who served as input data contributors voluntarily recorded their voices, both sober and intoxicated, for purposes of creating the training data. But, were they aware of the extent of the possible use of their voices? Were they under the impression their voices would be used purely for education or research-related purposes? And, to what extent do they have any privacy rights or abilities to control disclosure of their personal information? These questions remain unanswered.

The integration and collaboration of individualized data creates ongoing and mounting concerns for privacy violations.³⁶⁵ Among the privacy concerns for data subjects are “how data concerning individuals are collected to be bent into profiles, how individuals can control access to and processing of data relating to them, and how they might control the dissemination and

359. Huq, *supra* note 244, at 1930.

360. See *supra* note 38 and accompanying text; Lindsey Barrett, Note, *Deconstructing Data Mining: Protecting Privacy and Civil Liberties in Automated Decision-Making*, 1 GEO. L. TECH. REV. 153, 155–56 (2016).

361. Bonela et al., *supra* note 4, at 50.

362. *Id.*

363. Barrett, *supra* note 360, at 156.

364. *Id.* at 156–57.

365. Karen Levy, Kyla E. Chasalow & Sarah Riley, *Algorithms and Decision-Making in the Public Sector*, 17 ANN. REV. L. & SOC. SCI. 309, 318 (2021).

use of derived profiles.”³⁶⁶ While the initial compilation and analysis of voluntarily surrendered voices of data subjects is legitimate,³⁶⁷ analyzing the voices in a manner beyond that understood by the contributors may implicate privacy rights. The information gathered by ADLAIA conceivably could be utilized to infer entirely different information about the speaker than what was intended, such as health conditions apart from the imbibing of alcohol. Unintended, nonconsensual use of this information could harm the contributor by resulting in negative social consequences, like impacts on friendships and employment opportunities.³⁶⁸ Thus, having control over the dissemination of such information is paramount to prevent a violation of one’s privacy rights resulting from the use of one’s recorded voice for nonconsensual purposes, commercial or otherwise.³⁶⁹

Additional concerns stem from “the security and authenticity of information, the existence of effective means for ensuring the accuracy of data, and the integrity and safety from leaks and hacking attempts.”³⁷⁰ Data pools, even those voluntarily gathered for training purposes, create a risk of data breaches.³⁷¹ Whether negligent or malicious, data breaches can originate either from inside or outside an entity and may cause “unanticipated and socially inappropriate disclosures” resulting in “identity theft, fraud, [] reputational damage,” and “emotional distress.”³⁷² Further, the argument that an individual’s voice is only one unidentified voice of many does little to protect privacy rights. Often data can be “de-anonymized,” meaning that the same technology that anonymized the data has the ability to “re-identify” its contributor.³⁷³ Non-personal raw data “can be re-connected to individuals, and identities established from it.”³⁷⁴ And, from that point, the ordinary personalized information can be transformed “into data perceived as

366. Edwards & Veale, *supra* note 260, at 32–36.

367. Anne Logsdon Smith, *Alexa, Who Owns My Pillow Talk? Contracting, Collateralizing, and Monetizing Consumer Privacy Through Voice-Captured Personal Data*, 27 CATH. U.J.L. & TECH. 187, 193 (2018).

368. Shchory & Gal, *supra* note 356, at 158.

369. Almada & Maranhao, *supra* note 46, at 71–72. For discussions of voice identity theft, see Guangke Chen et al., *Who Is Real Bob? Adversarial Attacks on Speaker Recognition Systems*, 2021 IEEE SYMP. ON SEC. & PRIV. 1 (noting the threat of voice identity theft for speaker recognition systems); Craig S. Greenberg et al., *Two Decades of Speaker Recognition Evaluation at the National Institute of Standards and Technology*, 60 COMPUT. SPEECH & LANGUAGE 1, 2 (2019); Hildebrand et al., *supra* note 42, at 372 (“[S]peech synthesis applications could be used to generate entirely new, artificial soundwaves from the original voice data.”).

370. Rabinovich-Einy & Katsh, *supra* note 263, at 211.

371. Huq, *supra* note 244, at 1930.

372. *Id.* (quoting Daniel J. Solove & Danielle Keats Citron, *Risk and Anxiety: A Theory of Data Breach Harms*, 96 TEX. L. REV. 737, 745 (2018)).

373. Edwards & Veale, *supra* note 260, at 32–36.

374. *Id.* at 34.

especially sensitive.”³⁷⁵ So, while larger data sets make for increased analytic power, they also “increase the likelihood that anonymous data can be reassociated with an individual.”³⁷⁶ The result is that any suggestion of protection of one’s private information through anonymization is illusory. The ADLAIA voice pool shows the need for the law to adapt to these concerns as science and technology exponentially increase the breadth and depth of access to private personal information.³⁷⁷

G. First Amendment: Freedom of Speech and the Right of Assembly

When dealing with issues based on the use of literal voice, First Amendment concerns immediately come to mind. In relevant part, the First Amendment of the U.S. Constitution provides: “Congress shall make no law . . . abridging the freedom of speech, . . . or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances.”³⁷⁸ With respect to the right of peaceable assembly, the Court has held that the First Amendment protects the right to anonymous speech and association,³⁷⁹ and “[t]he Supreme Court has long recognized that government investigative activities, including surveillance, may implicate the First Amendment.”³⁸⁰ In defending against the disclosure of identities and personal information of group members, the Court recognized the “vital relationship between freedom to associate and privacy in one’s associations.”³⁸¹ That said, surveillance, without more, does not amount to a First Amendment violation.³⁸² For example, in *Laird v. Tatum*,³⁸³ the Court delicately skirted the issue of whether military surveillance of public meetings impermissibly chilled speech in violation of the First Amendment.³⁸⁴ When later given another opportunity to address the matter, the Court declined.³⁸⁵

But, increasing surveillance abilities garnered through improving technology likely means the matter is not resolved: Technology such as

375. *Id.* at 36.

376. W. Nicholson Price II, *Black-Box Medicine*, 28 HARV. J.L. & TECH. 419, 455 (2015).

377. See Ritter, *supra* note 48, at 744.

378. U.S. CONST. amend I.

379. See NAACP v. Alabama *ex rel.* Patterson, 357 U.S. 449, 466 (1958) (striking down a state order for the NAACP to disclose its membership lists); see also SANTAMARIA, *supra* note 24, at 22.

380. SANTAMARIA, *supra* note 24, at 22.

381. *Patterson*, 357 U.S. at 462.

382. SANTAMARIA, *supra* note 24, at 22.

383. 408 U.S. 1 (1972).

384. *Id.* 2–3, 10–14 (holding that allegations of a subjective chilling effect by “mere existence, without more, of a government investigative and data-gathering activity” does not constitute an injury sufficient to confer standing to sue).

385. See *Clapper v. Amnesty Int’l USA*, 568 U.S. 398, 417–18 (2013) (finding respondents lacked standing to challenge surveillance because they were not facing “certainly impending interception”).

ADLAIA may unconstitutionally restrict the rights to freedom of peaceful assembly and to freedom of association if it amounts to surveillance that translates to injury.³⁸⁶ While ADLAIA itself currently only detects intoxication, it could easily be combined with other voice analysis algorithms and thereby act as a pretext for surveillance that reveals far-reaching personal information. By analogy, it has been argued:

[A]n unregulated proliferation of facial recognition technology, in combination with the increased presence of public cameras, could lead to an Orwellian suppression of self-expression. With cameras scanning crowds at rallies, protests, bars, and nightclubs, people may become fearful of acting in any way that they would not be comfortable revealing to the general public.³⁸⁷

Akin to facial recognition technology, ADLAIA and related voice analysis technology foreseeably could be used at public events or in public arenas to identify individuals or to monitor speech. A perception of government surveillance may chill an individual's protected freedom of speech and association, such as "when an activist decides to not attend a political event because the association with an unpopular political group could lead to unlawful surveillance, retaliation, or punishment."³⁸⁸ Like facial recognition technology, ADLAIA could amount to a First Amendment infringement where citizens are deterred from gathering in certain locations or with certain others because "they fear surveillance from the

386. For a similar discussion regarding facial recognition technology, see Halie B. Peacher, *Regulating Facial Recognition Technology in an Effort to Avoid A Minority Report Like Surveillance State*, 25 MARQ. INTELL. PROP. & INNOVATION L. REV. 21, 30–31 (2021) ("[T]he use of facial recognition technology can create First Amendment issues by violating individuals' right to freedom of association and right to privacy. The use of facial recognition technology could have a chilling effect on individuals' behaviors, such as one's ability to associate freely and advocate for minority positions, which could lead to self-censorship." (footnote omitted)); Ted Claypoole, *Warrants Needed for Biometric Analysis*, 65 ST. LOUIS U. L.J. 859, 864–65 (2021) (The ability to focus on face after face, revealing name after name, must be examined for constitutionality unless the government's motivation clearly falls within permissible search parameters.); Kristine Hamann & Rachel Smith, *Facial Recognition Technology: Where Will It Take Us?*, A.B.A.: CRIM. JUST. MAG., Spring 2019, at 9, 12, https://www.americanbar.org/groups/criminal_justice/publications/criminal-justice-magazine/2019/spring/facialrecognition-technology ("[T]he use of FRT could have a chilling effect on individuals' behaviors and lead to self-censorship.").

387. Kirill Levashov, Note, *The Rise of a New Type of Surveillance for Which the Law Wasn't Ready*, 15 COLUM. SCI. & TECH. L. REV. 164, 175 (2013). ADLAIA algorithms for disclosing inebriation also could be used in conjunction with location-tracking technology as pre-emptive tool to prevent alcohol consumption by precluding certain associations (such as alerting to one's presence in a bar or liquor store). See also HUMAN RIGHTS OF AUTOMATED DATA PROCESSING TECHNIQUES, *supra* note 65, at 22–23 (2017) (describing how algorithmic monitoring on social media could stifle freedom of assembly).

388. Kirsten E. Roy, Note, *Defrosting the Chill: How Facial Recognition Technology Threatens Free Speech*, 27 ROGER WILLIAMS U. L. REV. 185, 194 (2022).

government.”³⁸⁹ Indeed, ADLAIA may be even more deterring than facial recognition technology in its ability to both identify the speaker and to monitor the content of his speech. As a result, ADLAIA may dissuade individuals from assembling if, by being traced to that location, they could be subjected to punishment.³⁹⁰ After all, if one knows that his very voice, regardless of content, may be used against him, it stands to follow that he may not speak. And, if he knows that his voice will be used to track his location, he may choose not to assemble. While the Court has held that government surveillance of speech must be connected to additional government action causing injury to provide redress for a First Amendment violation, this may well be such a case.³⁹¹

The use of artificial intelligence, in this context, also has a direct impact on one’s freedom of expression, including whether or not to communicate information. Taken to a semi-logical extreme, individuals may be precluded from expressing core values and beliefs, much less ordering their drinks or asking for directions to the restroom.³⁹² Gone may be the days when a group of friends gather at a local watering hole to publicly debate politics, religion, or sports teams in an environment equally accessible and inclusive to all, if their voices are being monitored.³⁹³ ADLAIA surveillance may cause some to self-censor all speech. As observed in the context of facial recognition, the “mere threat or fear of monitoring or identifying persons . . . could have a chilling effect on the exercise of constitutionally protected speech and assembly rights.”³⁹⁴

Though beyond the scope of this Article, it bears mentioning that statutory or common law may provide even greater protections of “rights in expression” than does the First Amendment.³⁹⁵ For example, in *Hudgens v. NLRB*,³⁹⁶ the Court made clear that “statutory or common law may in some

389. *Id.* at 201.

390. *See id.* at 204; SANTAMARIA, *supra* note 24, at 23.

391. *See Roy, supra* note 388, at 204–05 (“An activist seeking to challenge FRT for its chilling effect on his First Amendment rights could overcome the Article III hurdle if he can demonstrate that he chose not to engage in social media activism because of FRT, or otherwise altered his behavior because of FRT.”).

392. HUMAN RIGHTS OF AUTOMATED DATA PROCESSING TECHNIQUES, *supra* note 65, at 15 (discussing potential impact of using data collected in algorithms on a person’s “informational self-determination” and risk of distortion of information).

393. *Id.* (recognizing that using data based on algorithms may be “incomplete, inaccurate or outdated, thereby placing individuals in a distorted light, which may be prejudicial” and further discussing the potential for such monitoring to negatively impact an equally accessible and inclusive environment for public debate).

394. SANTAMARIA, *supra* note 24, at 21 (internal quotations omitted).

395. Genevieve Lakier, *The Non-First Amendment Law of Freedom of Speech*, 134 HARV. L. REV. 2299, 2301 (2021) (quoting *PruneYard Shopping Ctr. v. Robins*, 447 U.S. 74, 81 (1980)).

396. 424 U.S. 507 (1976).

situations extend protection or provide redress against [efforts] to abridge . . . free expression,” even when the First Amendment does not.³⁹⁷ The Court later opined that state constitutions might provide “rights in expression” that are “more expansive than those conferred by the Federal Constitution.”³⁹⁸ A situation may arise where ADLAIA-technology results in the monitoring of recreational activities (for example, those involving alcohol consumption) by those who disapprove of such behaviors, leading to “lifestyle discrimination,” which several states prohibit.³⁹⁹ As one lawmaker argued during legislative debates: “[W]e have long since passed the days of company towns, where the company told you when to work, where to live and what to buy in their stores. This bill would ensure that employers do not tell us how to think and play on our own time.”⁴⁰⁰ Thus, even beyond the prohibition against governmental intrusion on First Amendment rights, employers and private citizens should be aware of the legal implications of attempts to sanction individuals for their leisure-time activities.⁴⁰¹

III. HOW SHOULD THE LAW RESPOND?

This Article has touched upon issues with the use of audio-based deep-learning algorithms to detect inebriation, particularly in a governmental arena. This facet of artificial intelligence may unwittingly be poised to violate constitutional rights. The possibility that the government could use ADLAIA

397. Lakier, *supra* note 395, at 2301 (quoting *Hudgens*, 424 U.S. at 513).

398. *PruneYard*, 447 U.S. at 81; *see* Lakier, *supra* note 395, at 2301.

399. Lakier, *supra* note 395, at 2340–41 (collecting sources); *see* COLO. REV. STAT. ANN. § 24-34-402.5 (West 2023) (generally prohibiting an employer from terminating employment “due to that employee’s engaging in any lawful activity off the premises of the employer during nonworking hours”); N.D. CENT. CODE ANN. § 14-02.4-03 (West 2023) (prohibiting unfair treatment of an employee for a variety of reasons, including “participation in lawful activity off the employer’s premises during nonworking hours which is not in direct conflict with the essential business-related interests of the employer”); Jessica Jackson, *Colorado’s Lifestyle Discrimination Statute: A Vast and Muddled Expansion of Traditional Employment Law*, 67 U. COLO. L. REV. 143, 143 n.5 (1996) (asserting that the proposed Colorado law “was proposed by the tobacco lobby” but extended to protect all “‘lawful activities’ . . . [in] an effort to make the bill more appealing to the legislature as a whole”).

400. Alyce H. Rogers, *Employer Regulation of Romantic Relationships: The Unsettled Law of New York State*, 13 TOURO L. REV. 687, 690 (1997) (quoting Sen. James J. Lack Mem., Ch. 776, N.Y.S. LEGIS. ANN. (1992)).

401. *See* Lakier, *supra* note 395, at 2340–41; Jean M. Roche, *Why Can’t We Be Friends?: Why California Needs a Lifestyle Discrimination Statute to Protect Employees from Employment Actions Based on Their Off-Duty Behavior*, 7 HASTINGS BUS. L.J. 187, 198 (2011) (“Currently approximately 29 states have some type of statutory protection for lifestyle discrimination.”); Ann L. Rives, *You’re Not the Boss of Me: A Call for Federal Lifestyle Discrimination Legislation*, 74 GEO. WASH. L. REV. 553 (2006) (mentioning that “an Indiana corporation fired an employee for violating its policy prohibiting alcohol use under any circumstances when he admitted to superiors that he had a couple drinks in a bar with friends a few years earlier”); Stephen D. Sugarman, “Lifestyle” Discrimination in Employment, 24 BERKELEY J. EMP. & LAB. L. 377, 417 (2003).

to prosecute an individual based on criminal law violations has very real implications to individuals subjected to such technology. Likewise, the potential for negative implications in a civil arena should raise scrutiny by individuals looking to balance the benefits and the harms of ADLAIA-like technology. So, too, the inventors and companies potentially selling such technology should be keenly aware of the dangers that may lurk ahead.

At this juncture, deep-learning algorithms are good, but they may not be good enough. While they appear to out-perform humans in their ability to perceive precise levels of intoxication, they may not pass inquiry necessary for admissibility. Efforts at transparency and reassurance of accuracy should be demanded. To address bias, perhaps such technology should be subjected to independent review and oversight, though trade secret and other intellectual property protections present certain obstacles. In any event, the day likely is not far in the future when artificial intelligence will perform at a level needed to prove relevance and reliability. What then?

ADLAIA and its related technology may, indeed, prove to be life-saving. As a tool to enhance the existence and quality of life, it is important to pursue such technological advances. However protections should be in place to restrict its use in any adversarial proceedings, or at the very least, as inculpatory evidence in the criminal realm. Courts should respond by addressing potential constitutional violations associated with the unknowing use of ADLAIA. But current constitutional precedent may be insufficient to address these concerns. Rather, constitutional standards need to evolve to address the threats imposed by new technology. In a situation where courts may impose criminal penalties, the absence of some restriction on incriminating evidence gathered through audio-based deep learning algorithms to identify inebriation is risky, and perhaps unacceptable.

The need for limitations is true in any setting where ADLAIA's use is clandestine; the problem of unintended consequences may be avoided with informed consent, akin to medical consent. But how consent would occur and to what extent an individual needs to be informed are areas not explored.⁴⁰² For example, "[w]hen a device purchaser gives consent to collect the purchaser's voice data—either once for an indefinite duration, or, each time a query is made through the device—the consumer may not knowingly or intentionally give consent for the device servicer to share the data with third parties."⁴⁰³ The issue of consent is only further exacerbated when an individual has no knowledge of being subjected to ADLAIA, a fact which could have implications in criminal and civil situations. Meaningful, purpose-based consent would permit the speaker to make a decision about

402. Smith, *supra* note 367, at 207.

403. *Id.* at 207–08.

his willingness to speak with an understanding of the implications his conduct (speaking) could have. The informed-consent approach would avoid concerns that the use and capture of voice is compulsory as well as violations of the right to privacy. And, even when the initial purpose of the collection of voice recordings is civil, a barrier should exist between the use of those recordings collected for public safety and those used in criminal proceedings.

By imposing such limitations on the use of ADLAIA, the law is enforcing and respecting the autonomy of the individual, both in civil and criminal realms. That autonomy can be respected, even while permitting artificial intelligence and technological advances to improve the safety of the community. By placing limits on the scope and extent of the use of voice recordings, individual rights can be protected while public good is preserved. A balance may be achieved, and both goals attained.

This is not a matter where time and resources may discourage regulation; no additional laws need be passed, no regulations enacted. Rather, courts should take a fresh look at modern developments and the impact of AI on decades-old doctrine. No more can the law rest idly on its haunches, moving at a snail's pace and content with the application of outdated precedent. The rapidity with which technology is advancing and the inroads that artificial intelligence is making on individual rights demands immediate attention. To be sure, change is unsettling and decision making, hard, but to ignore the chasm of protection looming ahead is akin to jumping feet-first into that abyss.

CONCLUSION

An estimated 95,000 to 140,000 people die from alcohol-related causes annually in the United States.⁴⁰⁴ Alcohol misuse costs the United States roughly \$249 billion per year.⁴⁰⁵ According to the National Highway Traffic Safety Administration, alcohol-impaired crash fatalities account for thirty percent of all crash fatalities.⁴⁰⁶ So many lives could be saved from death,

404. *Alcohol's Effects on Health*, *supra* note 93; *Deaths from Excessive Alcohol Use in the United States*, CTRS. FOR DISEASE CONTROL & PREVENTION (July 6, 2022), <https://www.cdc.gov/alcohol/features/excessive-alcohol-deaths.html>; *Deaths and Years of Potential Life Lost from Excessive Alcohol Use — United States, 2011–2015*, CTRS. FOR DISEASE CONTROL & PREVENTION (Oct. 2, 2020), <https://www.cdc.gov/mmwr/volumes/69/wr/mm6939a6.htm#:~:text=Excessive%20alcohol%20use%20was%20responsible,an%20average%20of%2029%20years>.

405. *Economic Burden of Alcohol Misuse in the United States*, NAT'L INST. ON ALCOHOL ABUSE & ALCOHOLISM, <https://www.niaaa.nih.gov/alcohols-effects-health/alcohol-topics/alcohol-facts-and-statistics/economic-burden-alcohol-misuse-united-states> (last updated 2023).

406. *Facts + Statistics: Alcohol-Impaired Driving*, INS. INFO. INST., <https://www.iii.org/fact-statistic/facts-statistics-alcohol-impaired-driving> (last visited Dec. 15, 2023); *Impaired Driving: Get the Facts*, CTRS. FOR DISEASE CONTROL & PREVENTION,

from despair, from heartache, if only the future could be predicted. Perhaps deep-learning algorithms provide a glimpse into such a future, at least with respect to detecting a person's level of intoxication and, accordingly, perhaps thwarting his likelihood of being involved in a motor vehicle collision. By "listening," with AI "ears" to only twelve seconds of speech, ADLAIA may predict and prevent the devastating impacts of behaviors related to inebriation, both to the intoxicated individual and to others, more accurately and more reliably than any trained human ear ever could. And, it can do so quickly, inexpensively, and noninvasively; indeed, undetectably.

There is, however, a tradeoff to these undeniable benefits in the form of the potential bending of individual rights—especially as other voice analysis algorithms, which could easily be combined with ADLAIA, grow more powerful. From the initial police-citizen interaction through the trial and into the private realm, technology that permits the disclosure of such private information by analyzing the literal voice accompanies troubling constitutional concerns. The constitutional constraints created by the First, Fourth, Fifth, Sixth, and Fourteenth Amendments, as well as other protections implicit in the U.S. Constitution offer protections against governmental overreaching. Are citizens prepared to lessen their privacy expectations, even unknowingly, by permitting audio-based deep learning algorithms to assess their physical states, their emotional states, and their biometrics? As society grapples with the benefits and risks associated with ever-improving technology, gone may be the days when the bar patron feels comfortable being seen and heard entering the neighborhood tavern alongside his proverbial friend, Norm Peterson, to the tune of "Where Everybody Knows Your Name."⁴⁰⁷

https://www.cdc.gov/transportationsafety/impaired_driving/impaired-drv_factsheet.html (last visited Dec. 15, 2023).

407. *Cheers* (NBC television broadcast Sept. 30, 1982).