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Awareness and perception of artificial intelligence operationalized integration in news media industry and society

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Abstract

This study attempts to determine a correlation effect between people's perception and awareness of the operationalization of artificial intelligence in their everyday lives and in the production, presentation, and publication of news media in the U.S. By looking at the effect individual characteristics may have on a person's perception and awareness of AI operationalized for news media and looking at whether perception and/or awareness of AI operationalized in a person's daily life affects their perception and awareness of AI operationalized for news media, we seek to find correlation between these two factors. The research relies on Actor-network theory, the MAIN (Modality, Agency, Interactivity, Navigability) Model, and utilizes a convenience sample survey method using the MTurk participant platform.

Keywords Actor-network theory, Artificial intelligence, Human-computer interaction, Human-machine communication, Journalism, News media

Introduction

In many ways, technology defines the relationship between news media and its audience. Over the course of history, there have been defining technologies that altered the news media industry radically (e.g., telegraph, radio, television, and the

internet), and technologies which provided minor changes in the way journalism is conducted. For example, electronic word processors, digital cameras, and High-Definition broadcast display. Across these changes, technology a human-only messenger system.[1] This latest advance in communication technology urges us to recognize news as information written by human and synthetic journalists (bio- logical and non-biological agents). Why is this important?

By placing the machine in the role of communicator and mediator, an ontological assuredness that humans communicate and machines mediate communication becomes obsolete (Guzman 2018). In other words, AI operationalized for journalism becomes the medium and the messenger and human journalists not only have a new tool to aid has been the medium and human journalists were the messengers (Guzman 2018). That exclusivity no longer exists thanks to recent advances in communication technology. Artificial Intelligent (AI) machines capable of performing in the communicator role have emerged as an alternative to human journalists. This innovation in news content production fundamentally changes journalism away from their news making, but also a new non-biological colleague and (potentially) competition for their job. Are consumers of news aware of this shift taking place? To what extent are people aware of technology being wholly responsible for the information they consume, and how do they perceive the existence of AI operationalized for news production? This research investigates to what extent awareness and perception of AI operationalization exists. To do so, this paper focuses on those technologies that have been developed to take the place of human journalists in producing and presenting news content to an audience.

Some implementation of AI replaces the need for human journalists while others aid human journalists in their traditional role and function by providing assistance. Forbes designed “Bertie”, an AI engine for their content management

[1] As early as 2006, Thompson Reuters began using algorithms to automatically generate financial news content to free up human journalists for more nuanced reporting that computers were incapable of producing (Dalen 2012). Other news organizations have begun to rely on AI to produce similar news content (e.g., sports articles, elections, and earnings reports). Xinhua news agency, in collaboration with Sogu search company, produced the first male and female AI broadcast news anchors. Thompson Reuters is now in expanded development of similar technology to generate a male persona AI news anchor.

system (CMS) to perform the role of intelligent asset manager and newsroom assistant. Bertie can more effectively aid reporters develop news articles by identifying trends, suggest headlines, and provide visual content matching to relevant stories (Zalatimo 2018). Forbes has also been using Bertie to report company earnings since 2012 (Graefe et al. 2018). Thompson Reuters has been working with AI since 2006 and is one of the earliest identified news organizations to rely on intelligent machine generated news content (Dalen 2012). In 2018, Reuters began trialing Lynx Insight, an AI analysis assistant/copywriter, to aid journalists in story development (Kobie 2018). Other news operations, such as the Washington Post, with their AI "Heliograf", and the AP's partnership with Automated Insights, who developed an AI program "Wordsmith", are operationalizing AI to perform in the role of the journalist using Natural Language Generators (NLG) to produce short news articles with limited human intervention. The Washington Post published approximately 850 non-human news articles, covering sports and elections, in the first year since they brought Heliograf online in 2016 (Moses 2017). The AP relies on Wordsmith to provide earnings coverage, sports news coverage, and other data-driven brief news articles. In just 2016, Wordsmith generated 1.6 billion stories for The AP (Miroshnichenko 2018).

AI has been conceptually defined by numerous scholars (see Bellman 1978; Comer et al. 1989; Diakopoulos 2019; Haugeland 1985; Miroshnichenko 2018; Nilsson 1998; Poole et al. 1998; Russell and Norvig 2010). AI operationalized in the performance of journalism has been referred to by a mix of concepts: computational journalism (Ander- son 2013a; Lindén 2017; Waddell 2019), automated journalism (Carlson 2015; Graefe 2016; Zheng et al. 2018), algorithmic journalism (Dörr 2016), and robo-journalism (Miroshnichenko 2018). Though discrete characteristics are exhibited in these conceptual definitions, each possess the fundamental element of a technology operating on an intelligent algorithm programmed to function autonomously. We define AI as that intelligence opposite of natural intelligence, designed to match machine performance to human performance, or exceed it where human/natural fallacy may inhibit human/natural performance (Miroshnichenko 2018). The AI operationalization referred to here is that form of the technology which

is designed into software capable of con- structing a narrative from structured data formatted in a news style and presenting it to an audience with little or no human involvement after its initial programing (Carlson 2015; Lewis et al. 2019).

Research into people's knowledge and understanding of AI operationalized for journalism as we have identified it is growing, however, much of the scholarly attention has been on credibility and distinguishability between artificial and human constructions (see Anderson 2013b; Carlson 2019; Dörr 2016; Graefe et al. 2018; Kaplan and Haenlein 2019; Lehmuskallio et al. 2018; Miroshnichenko 2018; Waddell 2019; Zheng et al. 2018). The question of whether people generally are aware of AI writing or broadcasting their news has largely been overlooked. More than 90% of adults in the U.S. consume news in one or more variety of formats each day (McWhorter 2019). A recent study of Facebook and Twitter users found that half of platform users get their news from their respective social media platform (McWhorter 2019). These numbers support a heightened sense of importance to better understand inclusion of AI technology in the stream of news production.

This study attempts to address that discrepancy of research into people's awareness and perception of AI integrated into the news media process by researching whether a correlation effect exists between people's perception and awareness of AI operationalized in everyday life and their perception and awareness of AI operationalized to pro- duce, present, and publish news media. Prior research, and research upon which this research is based, has investigated attitude towards AI inclusion in everyday experiences. Research into attitude has examined people's opinion on the topic of AI inclusion in society (see, for example, Operto 2019; Ray et al. 2008; Special Eurobarometer 460 2017). Our study adds to this body of literature that explores integration of AI technology into society by asking the question whether and to what extent people are aware of AI functioning in their environment and how they perceive AI in operation.

Specifically, the focus of this study is to measure people's general awareness and perception of AI operationalized in the news media industry by conducting a convenience sample survey. This study looks at two possible effects. One, the effect individual characteristics may have on a person's perception and awareness of AI

operationalized for news media, and two, whether perception and/or awareness of AI operationalized in a person's daily life affects their perception and awareness of AI operationalized for news media.

Literature review

Prior research has found people tend to either prefer news written by artificial intelligent agents as opposed to human journalists, or they are unable to distinguish the difference between these two writers (see Clerwall 2014; Edwards et al. 2014; Graefe et al. 2016; Sundar 2008; Sundar and Nass 2001). Though these scholars provide exquisite scholarship on the preference of the reader who is aware of the coexistence of these two types of journalists, their studies do not clarify how the person becomes aware of, or recognize, AI in this operation.

Actor-network theory (ANT) offers a way to view these interactions and communications as relationships in a social exchange, theorizing that the nature of a social relationship can be both semiotic and material (Seuwou et al. 2016). ANT, together with Shyam Sundar's (2008) MAIN model theory, provides insight into a person's capacity to identify message source. ANT asserts the roles of the intermediary[2] and the mediator[3] as interchangeable (Latour 2005). In other words, a highly complex and sophisticated computer assembly, previously considered an intermediary, infused with an AI would be considerable as a functioning mediator by ingesting vast amounts of data and transforming this information into a natural human-language interpretation for other humans to read and become informed. Conversely, the expected function of a human journalist is primarily to transport information without transformation (interpretation), as in when publishing or broadcasting hard news or breaking news, sports outcomes, or finance and earnings reports, thus relegating the mediator to a formulaic and unremarkable intermediator. Discussing agency, Sundar (2008) identifies how source assignment in modern

[2] The intermediary refers to a 'thing' as a 'mean' or 'tool' and is defined as an entity capable of transporting meaning without transformation (i.e., a computer) (Latour 2005).
[3] A mediator is defined as an entity capable of transforming, distorting, and/or modifying meaning (Latour 2005).

online mass communication can be obfuscated by the device, user-interface (UI), or user-experience (UX), thus rendering source identification irrelevant. Source assignment becomes relegated to the psychological assignment of authorship in the message recipient (Sundar 2008). Agency becomes more reliant on a person's reception of the information and less on true attribution (Sundar 2008). Therefore, we can say that reception media as source assignment could be a method of perceiving with or without awareness.

Perception is defined as "all of the ways one person can view another person" (McCroskey and Young 1979, p. 376). In this way, perception can be inferred to include *all the ways a person can see*. Perception can also be defined as comparing new sensory input against preexisting knowledge through a subjective and progressive, performative process to under- stand the surrounding environment (Nelson 2008). We consider perception to be understood as *building the ability to recognize or identify*. This, however, does not equate perception with awareness, nor does it presume perception (of a thing) is impossible without being aware of perceiving (the thing). Researchers have demonstrated it is possible to perceive a stimulus and record the information subconsciously through semantic priming (Merikle et al. 2001). This would render a subject able to recall information consciously even when visual information is presented below an "objectively defined threshold for awareness" (Merikle et al. 2001, p. 121). Perception, therefore, can be operationally defined by levels of recognition or identification.

Awareness is the ability to know. Knowing makes it possible to be aware without the ability to verbalize that aware- ness (Leow et al. 2011). Tomlin and Villa (1994) define awareness as "a particular state of mind in which an individual has undergone a specific subjective experience of some cognitive content or external stimulus" (p. 193). Gafoor (2012) empirically defines awareness by three distinct levels: (1) "knowledge from milieu" (p. 7), that is knowledge without the requirement of teaching, or knowing something is or exists, (2) self-perception, derived from psychology as knowledge of the self, and (3) "the ability to deal with" (p. 8), demonstrating the agent is capable of displaying skill or talent to accomplish a task or challenge.

Having established this understanding of awareness and perception, we can ask: how does a person perceive the presence of AI, and are they aware of AI when they encounter it in operation? If the reader is unable to distinguish a difference between the two types of authors (Clerwall 2014; Miroshnichenko 2018; Zheng et al. 2018), does this allude to an issue of whether the reader has prior awareness of the existence of an alternative source of authorship other than human?

To answer these inquiries, we have translated the questions into:

RQ1: How does the level of a person's perception of AI integration into news media information vary as a function of individual characteristics?

RQ2: How does the level of a person's awareness of exposure to AI integration into news media and information vary as a function of individual characteristics?

RQ3: How does the level of a person's perception of AI integration into news media information vary as a function of the person's perception of AI integration into society?

RQ4: How does the level of a person's awareness of exposure to AI integration into news media information vary as a function of the person's awareness of AI integration into society?

Methodology

This study, using an online survey method, relied on an online convenience sample (*N* = 385) from Amazon's crowdsourcing platform, Mechanical Turk, otherwise referred to as *MTurk*, in June 2020. While Amazon's MTurk platform is not generalizable to the larger U.S. population,[4] researchers agree that the pool is more diverse than student populations from which a significant collection of scholarly research in the social sciences have been conducted, with findings commonly assumed to represent the broader population (Buhrmester et al. 2018; Sheehan 2018). Recruitment of participants is discussed later in this section.

[4] Researchers found that MTurk exhibited concerns regarding demo- graphic mapping to U.S. census data. According to Buhrmester et al. (2018), the pool is not representative of the U.S. population. Sheehan (2018) notes in her findings that workers on MTurk are generally younger than the U.S. population overall, better educated, predominately Caucasian, and mostly male.

Study participants

Following Cochran's Sample size formula, $n_0 = \frac{Z_{pq}^2}{e^2}$, an a priori power analysis was conducted to determine a minimum 385 participants (*N* = 385) would be needed to reach a 95% confidence level, *a* = 0.05 ($(1.96)^2(0.5)(0.5)/ (0.05)^2$ = 385) (Israel, 1992). Sample population numbers came from the 2010 U.S. census for adults age 18 and over (*N* = 234, 564, 071) (Howden and Meyer 2011). Nielsen (2019) Q1 demographic classification provided age classification (18–34, 35–49, 50–64, 65+)[5] (The Nielsen Total Audience Report 2019). Using this age grouping model, the total population was parsed into 71,736,036 (age 18–34) = 31%, 63,779,197 (age 35–49) = 27%, 58,780,854 (age 50–64) = 25%, and 40,267,984 (age 65 and over) = 17%. By applying percentages to age groups for the sample size (*N* = 385), we arrived at these minimum participation levels necessary to satisfy the power analysis: 118 (age 18–34), 105 (age 35–49), 96 (age 50–64), and 66 (age 65 and over).

Recruitment

This survey utilized a crowdsourcing resource, MTurk, growing in popularity among researchers[6] to provide a convenience sample for this study. A project request describing the purpose of the survey was posted on the MTurk worker request website with a URL link to the survey which was administered through Qualtrics. According to prior studies conducted on MTurk's reliability and validity, the service provides a more diverse population than student populations, is cost efficient, and data can be collected quickly (Buhrmester et al. 2018; Sheehan 2018). Following the advice of previous literature, a clear and explicit set of instructions was given for respondents to review prior to the start of the survey and attention checks (for our purpose, questions regarding residence and age) were implemented to ensure only

[5] According to the Nielsen Total Audience Report: Q1 2019, adults age 18–34 are a targeted interest group for marketers, the 35–49 age group is the "key" market, and people age 50–64 have been consistently the largest group of media consumers (The Nielsen Total Audience Report 2019).
[6] MTurk workers accounted for more than 40% of studies published from 2012 to 2017 in the Journal of Consumer Research, and many other fields, such as psychology and political science, rely on MTurk for data collection (Sheehan 2018).

qualified participants were allowed to participate. In addition, a random survey ID number was generated to authenticate a valid participant response while ensuring anonymity each time a respondent initiated a new survey.

A total 1187 responses were received. Of the total 1187 responses initiated, 338 respondents were rejected for attempting to complete the survey outside of the designated age groups[7] and an additional 354 were rejected for responding that they resided outside of the US. When a respondent's submitted survey ID number could not be verified against the master list of generated ID numbers, that survey was rejected and the allotted space was reopened on MTurk for additional response opportunity until a response met all qualifying participation criteria. Of the final 495 qualified responses, 106 participants did not complete the survey, resulting in an attrition rate of 27%. Participants who successfully submitted a complete qualified response received $1 U.S. dollar. Approval by the institutional review board was instituted in this study.

Sample

Targeting age groups best represent the social diversity essential to our measurements. Since this research is interested in the perception and awareness of people interacting with AI during the process of news media consumption, age stratification based on Nielsen media consumption findings was determined the most appropriate method. The necessary minimum number of participants based on age was met or exceeded (30% age 18–34 (N = 118), 28% age 35–49 (N = 109), 25% age 50–64 (N = 96), 17% age 65 or over, (N = 66). The full lists of sociodemographic and socioeconomic diversifiers are referenced in Tables 1 and 2.

Variables

This study attempts to measure two primary variables: the influence of individual characteristics on perception and awareness of AI operationalized for news media, and the influence of perception and/or awareness of AI operationalized

[7] To facilitate participant payment, four separate instances of the survey were initiated on the Qualtrics platform. An attention check asking for the respondent's age-limited responses to meet the desired amount of participation to satisfy a 95% confidence level per age group.

in general to a person's life on their perception and awareness of AI operationalized for news media. To avoid contaminating participant responses based on their pre-established understanding of AI, we intentionally excluded any attempt to define AI or explain discrete operationalization based on fields of implementation (e.g., medical, social, communication) from the survey instructions or question descriptions. To determine to what extent perception and awareness is dependent on a person's individual characteristics, in addition to non-identifying sociodemographic questions, the survey asked participants to answer questions regarding usage (time and method) of technology, and ownership (qty and type) of electronic devices. Respondents were also asked questions intended to measure perception and awareness of encountering AI operationalized in their everyday life experiences (e.g., in the home, at work, and outside of these two areas) as well as questions to determine their perception and/or awareness of AI operationalized in production, publication, and presentation of news media.

Table 1 Sociodemographic data of sample population

		N	**Percent**
Sex			
	Male	256	65.81
	Female	131	33.68
	Prefer not to say	2	0.51
Age			
	18-34	118	30.33
	35-49	109	28.02
	50-64	96	24.68
	65 or older	66	16.97
Ethnicity			
	White	296	70.09
	Black or African American	31	7.97
	American Indian or Alaska Native	31	7.97
	Asian	25	6.43
	Native Hawaiian or Pacific Islander	2	0.51
	Other (please specify)	4	1.03
Education			
	High school graduate	14	3.6
	Some college	24	6.17
	2-year degree (associate or equivalent)	12	3.08
	4-year degree (Bachelor or equivalent)	227	58.35
	Professional degree	28	7.2
	Graduate degree (masters or equivalent)	78	20.05
	Doctorate	6	1.54
Total		389	100

Table 2 Socioeconomic data of sample population

		N	**Percent**
Employment			
	Employed full time	336	86.38
	Employed part time	19	4.88
	Unemployed	10	2.57
	Business owner (entrepreneur)	11	2.83
	Retired	10	2.57
	Student	3	0.77
Experience Level			
	Intern	1	0.26
	Entry-level	39	10.03
	Associate	52	13.37
	Manager	188	48.33
	Senior management	62	15.94
	Director	12	3.08
	Vice president	4	1.03
	Senior vice president	4	1.03
	C-level executive	4	1.03
	President or CEO	6	1.54
	Owner	12	3.08
	Other (please specify)	5	1.29
Industry			
	Automotive	8	2.06
	Electronics	22	5.66
	Aerospace	7	1.8
	Chemical/pharmaceutical	4	1.03
	Industrial robot	33	8.48
	Defense	6	1.54
	Telecommunications	29	7.46
	Construction	29	7.46
	Mass media communication	11	2.83
	Financial services	48	12.34
	Insurance	11	2.83
	Health care	21	5.4
	Food and hospitality	19	4.88
	Information and technology	69	17.74
	Software development	13	3.34
	Entertainment	19	4.88
	Education	15	3.86
	Video game	1	0.26
	Transport	3	0.77
	Other (please specify)	21	5.4
Hours of work per week			
	30 or fewer	34	8.74
	31-40	217	55.78
	41-50	119	30.59
	50 or more	19	4.88
Income			
	Less than $10,000	13	3.34
	$10,000-$20,000	22	5.66
	$20,000-$35,000	57	14.65
	$35,000-$50,000	100	25.71
	$50,000-$85,000	119	30.59
	$85,000-$100,000	54	13.88
	More than $100,000	24	6.17
Total		389	100

Since 2012, three large-scale studies on people's attitude towards robots and artificial intelligence have been con- ducted (Operto 2019; Special Eurobarometer 460 2017). These surveys, along with a survey conducted in 2008, served as a framework to construct the questions for this study (Ray et al. 2008). Since attitude is not relevant to this study, some questions asked in the original surveys were not relevant and therefore dismissed. Questions QD8, QD9, QD12, and QD13 from the 2017 survey were adopted into use for this study and verbiage targeting attitudes and perceptions of robots was adjusted to address AI. Since QD9 addressed AI directly, this question was retained in its original form. Considering an alternative set of sociodemographic questions and that the sample population for this study differs from the 2017 study, this question was added directly because of its relevance to this study. New findings can be extracted from the responses that are not measurable from the previous study. Additional questions targeting participants awareness or perception of AI in news media information production, presentation, and publication were added to address those focus areas of this study by the authors.

Analysis

The survey for this study was prepared and hosted on Qualtrics' survey software platform. Participants recruited through Amazon MTurk were given a link to the survey. Once all surveys were completed, the data were downloaded from Qualtrics then uploaded into SPSS for analysis. We began with simple frequency measurements and concluded with ordinal regression and simple linear regression measurements. We first wanted to gain a general understanding of participant's awareness and perceptions of AI at work in everyday experiences and in journalism and media and see how results from our survey compared to results from the survey out of Europe. With this information, we could progress to answering our research questions by running regression tests. We first measured nominal socioeconomic data against questions intended to measure awareness and perception which relied on ordinal data using ordinal regression. For the second measurements, we relied on simple linear regression to test for significance between questions measuring ordinal data (awareness and perception in everyday activities and awareness and

perception in journalism and news media).

Findings

While not explicitly asked as a research question in this study, people's level of awareness and perception of AI operationalized in the production of journalism and news media became a notable finding. We begin our findings by addressing frequency levels because the results (while not measured for significance) do indicate the possibility of disparity between general awareness and perception of AI in use and AI in use specifically for the production and dissemination of news. See Tables 3, 4, 5 and 6 for frequencies of potential exposure to AI through media consumption, frequencies of awareness, and frequencies of perception.

Less than half of all participants were certain of their general awareness of AI (48%). For example, only 39% of participants claimed to have used a device operating on AI at work or at home while 61% of respondents claimed to own and operate a smartphone, an association which we will address in the conclusion. Awareness declined when asked about specific applications of AI though most participants generally favored a belief that AI would eventually become more prevalent if not already in operation. Positive responses towards questions pertaining to medical operations (32%), assistance at work (35%), assistance for the elderly or infirm (31%), and autonomous vehicles (30%) where participants agreed AI is presently capable were near or above 30%. Awareness of AI operationalized for journalism (e.g., reading a news article written by AI) and broadcast news (e.g., watching a newscast reported and presented by an AI avatar) were the lowest, with 29% of the sample aware of AI in use for journalism, 22% of participants believing they have listened to an AI-produced and presented news broadcast (radio, podcast, or other audio source) in the past 6 months, and only a 19% awareness of AI used in broadcast news. In all cases except reporting and presenting broadcast news, responses favored the potential for AI to operate even if not already doing so. General perception of AI capabilities ranked generally consistent with awareness. Problem solving (36%) was most associated with AI while controlling human behavior (14%) was least associated with AI capabilities. A quarter of participants perceived AI

as capable of writing or reporting news equal to or better than human journalists (25%).

With this frequency data in mind, we could begin looking at the possibility of influence socioeconomic characteristics may have on a person's awareness and perception of AI operationalized for news media. The results after conducting ordinal linear regression and simple linear regression tests to predict whether individual characteristics or general awareness and perception of AI would influence a person's awareness of AI operationalized for journalism or broadcast news were, for the most part, insignificant. However, some significant effects were discovered in ways that could be anticipated, that increased general awareness would increase awareness specifically in journalism and broadcast news, and two that were not.

We began by addressing our first two research questions: how does the level of a person's perception of AI integration into news media information vary as a function of individual characteristics, and how does the level of a person's awareness of exposure to AI integration into news media and information vary as a function of individual characteristics?

An ordinal regression was calculated to predict whether participants would agree or disagree that an AI application is capable of writing and reporting general news equal to (or better than) a human journalist based on their demographic data. A significant regression equation was found based on ethnicity (F (9, 379) = 1.93, $p <$ 0.05), with an R^2 of 0.044. In other words, ethnicity was the sole individual characteristic which played a significant role in determining a person's perception of AI capability to successfully negotiate the tasks of a journalist.

Based on these data, we can say that awareness and perception of AI integration into news media information, in almost every case, does not vary as a function of individual characteristics. With the first two research questions addressed, we measured for influence based on awareness and perception of AI operationalized in everyday application. Research questions three and four, asked: how does the level of a person's perception of AI integration into news media information vary as a function of the person's perception of AI integration into society, and how does the level of a person's awareness of exposure to AI

Table 3 Frequencies of potential exposure to AI

	Frequency (out of 389)	Percentage
Devices operating in home		
Smartphone (e.g., iPhone, Samsung Galax, and Sony Xperia)	238	61.2
Smart watch (e.g., Apple watch, Samsung Galaxy, Fitbit Versa, and Garmin Fenix)	131	33.7
Desktop computer	200	51.4
Laptop computer	266	68.4
Tablet Computer (e.g., iPad and Samsung Galaxy)	121	31.1
Streaming media player (e.g., Apple TV, Amazon Fire TV, and Roku)	104	26.7
Number of internet-connected devices owned in the home		
0	1	0.3
1-3	245	63.0
4-9	121	31.1
10 or more	22	5.7
Average number of internet-connected devices carried on the person every day1.3		
0	5	1.3
1-3	282	72.5
4-9	97	24.9
10 or more	5	1.3
Encountered in the past 6 months – Email spam filters		
Absolutely yes	144	37.0
Possibly yes	139	35.7
Unsure, Possibly yes, possibly no	43	11.1
Probably not	45	11.6
No, definitely have not	11	2.8
Do not know	7	1.8
Encountered in the past 6 month – predictive search terms		
Absolutely yes	139	35.7
Possibly yes	130	33.4
Unsure, Possibly yes, possibly no	63	16.2
Probably not	32	8.2
No, definitely have not	16	4.1
Do not know	9	2.3
Encountered in the past 6 months – Siri virtual assistant		
Absolutely yes	138	35.5
Possibly yes	117	30.1
Unsure, Possibly yes, possibly no	58	14.9
Probably not	30	7.7
No, definitely have not	42	10.8
Do not know	4	1.0
Encountered in the past 6 months – online virtual assistant		
Absolutely yes	115	29.6
Possibly yes	141	36.2
Unsure, Possibly yes, possibly no	58	14.9
Probably not	41	10.5
No, definitely have not	27	6.9
Do not know	7	1.8
Encounter in the past 6 months – Facebook-recommended news		
Absolutely yes	130	33.4
Possibly yes	109	28.0
Unsure, Possibly yes, possibly no	70	18.0

Table 3 Frequencies of potential exposure to AI continued		
Probably not	38	9.8
No, definitely have not	31	8.0
Do not know	11	2.8
Encounter in the past 6 months – online shopping recommendations		
Absolutely yes	129	33.2
Possibly yes	129	33.2
Unsure, Possibly yes, possibly no	62	15.9
Probably not	32	8.2
No, definitely have not	28	7.2
Do not know	9	2.3
Encounter in the past 6 months – home virtual assistant		
Absolutely yes	122	31.4
Possibly yes	123	31.6
Unsure, Possibly yes, possibly no	49	12.6
Probably not	36	9.3
No, definitely have not	46	11.8
Do not know	13	3.3
Interact with a technology device in your personal life by speaking commands to it		
Less than once per week	52	13.4
At least once per week	99	25.4
Multiple times per week	115	29.6
At least once per day	52	13.4
Multiple times per day	53	13.6
Never	18	4.6
Interact with a technology device provided by your employment at work for the purpose of work by speaking commands to it		
Less than once per week	35	9.0
At least once per week	92	23.7
Multiple times per week	105	27.0
At least once per day	57	14.7
Multiple times per day	39	10.0
Never	61	15.7
Have you ever used, or do you currently use a device on artificial intelligence at home or at work		
Absolutely yes	153	39.3
Possibly yes	158	40.6
Unsure, Possibly yes, possibly no	39	10.0
Probably not	22	5.7
No, definitely not	14	3.6
Do not know	3	0.8

Potential exposure to AI is considered on the basis that these technologies (or some portion of) operate on some form of AI and knowledge of the type of AI operationalized and how it performs is available to the general public through promotional advertising or news coverage

integration into news media information vary as a function of the person's awareness of AI integration into society?

A simple linear regression was calculated to predict whether participants would agree or disagree that they have read a news story written by AI in the past 6 months based on general awareness of AI operationalization. A significant

regression equation was found based on the degree to which they agreed or disagreed AI applications capable of performing a medical operation exist today or will exist in the future (F (4, 384) = 3.597, $p < 0.05$), with an R^2 of 0.036. Participants predicted response to whether they agree or disagree an AI application capable of performing a medical operation currently exists or will exist in the future was 2.099 + 0.098 when measured on a 10-point Likert scale. This indicates that as the participants tendency to agree AI medical operations are or will be conducted, the likelihood of them agreeing they had read a news article entirely written by AI in the past 6 months increased slightly.

Table 4 Frequency of exposure to news media

		Frequency (out of 389)	Percent
Watch news broadcast			
	TV (at home)	222	57.1
	Laptop PC	273	70.2
	Tablet	108	27.8
	Smartphone	195	50.1
	TV outside (i.e., restaurant, bar, airport departure lounge, …)	36	9.3
Listen news broadcast			
	Radio (at home)	140	36.0
	Radio (in car)	133	34.2
	Radio (at work)	76	19.5
	Podcast (or streaming app) on smart watch	76	19.5
	Podcast (or streaming app) on smart phone	136	35.0
	Podcast (or streaming app) on a tablet	54	13.9
	Podcast (or streaming app) on a laptop or PC	88	22.6
Read news article			
	Print newspaper	116	29.8
	Online news source (e.g., Washington Post website)	267	68.6
	News aggregation app	118	30.3
	Social media feed	167	42.9

Participants were asked to select all the ways in which they consume news media

Another simple linear regression was calculated to predict whether participants would agree or disagree that they have listened to a news broadcast written and presented by AI in the past 6 months based general awareness of AI operationalization. A significant regression equation was found based on the degree to which they agreed or disagreed AI applications providing service and companionship to the infirm or elderly exist today or will exist in the future (F (4, 384)

= 3.671, $p < 0.05$), with an R^2 of 0.037. Participants predicted response to whether they agree or disagree AI applications providing service and companionship to the infirm or elderly exist today or will exist in the future was 2.363 + 0.106 when measured on a 10-point Likert scale, indicating that as the participants' tendency to agree AI providing service and companionship to the infirm or elderly exists today or will exist in the future, the likelihood of them agreeing they had listened to a news broadcast written and presented by AI in the past 6 months increased slightly.

Table 5 Frequencies of perception

		Frequency (out of 389)	Percent
Replicate human behavior			
	Definitely true	94	24.2
	Probably true	156	40.1
	Neither true nor false	75	19.3
	Probably false	55	14.1
	Definitely false	9	2.3
Learn			
	Definitely true	129	32.9
	Probably true	138	35.5
	Neither true nor false	75	19.3
	Probably false	33	8.5
	Definitely false	15	3.9
Problem solving			
	Definitely true	139	35.7
	Probably true	133	34.2
	Neither true nor false	57	14.7
	Probably false	41	10.5
	Definitely false	19	4.9
Speech interpretation/translation			
	Definitely true	137	35.2
	Probably true	138	35.5
	Neither true nor false	65	16.7
	Probably false	39	10.0
	Definitely false	10	2.6
Feel emotions			
	Definitely true	73	18.8
	Probably true	81	20.8
	Neither true nor false	83	21.3
	Probably false	76	19.5
	Definitely false	76	19.5
Control human behavior			
	Definitely true	54	13.9
	Probably true	120	30.8
	Neither true nor false	98	25.2
	Probably false	71	18.3
	Definitely false	46	11.8
World domination			

Table 5 Frequencies of perception continued			
	Definitely true	77	19.8
	Probably true	108	27.8
	Neither true nor false	77	19.8
	Probably false	67	17.2
	Definitely false	60	15.4
Think logically			
	Definitely true	106	27.2
	Probably true	138	35.5
	Neither true nor false	82	21.1
	Probably false	37	9.5
	Definitely false	26	6.7
Play games			
	Definitely true	132	33.9
	Probably true	130	33.4
	Neither true nor false	70	18.0
	Probably false	46	11.8
	Definitely false	11	2.8
Surveillance			
	Definitely true	122	31.4
	Probably true	132	33.9
	Neither true nor false	76	19.5
	Probably false	32	8.2
	Definitely false	27	6.9
Replace human workers			
	Definitely true	110	28.3
	Probably true	134	34.4
	Neither true nor false	77	19.8
	Probably false	47	12.1
	Definitely false	21	5.4

Participants were asked to rate on a Likert scale the likelihood of believability that AI is capable of performing the listed task

Finally, when a simple linear regression was calculated to predict whether participants would associate the word “journalism” with AI based on general awareness of AI capabilities, a significant regression equation was found based on the degree to which they agreed or disagreed AI applications are capable of feeling emotion (F (11, 377) = 3.062, $p < 0.05$), with an R^2 of 0.082. Participants predicted response to whether they agree or disagree an AI application is capable of feeling emotion was 1.303 + 0.049 when measured on a five-point Likert scale. As the participants’ tendency to agree an AI application is capable of feeling emotion, the likelihood of them associating the word “journalism” with AI increased slightly. In these instances, the participants’ positive awareness of AI in general associations led to a significant positive awareness of AI capable of performing in journalistic and

broadcast news reporting capacity.

In other instances, the results of a simple linear regression revealed behavior inconsistent with this positive association. Unlike the positive correlation found between a person's association of AI with medical operations and reading a news article written by AI, when a simple linear regression was calculated to predict whether participants would associate the word "journalist" with AI based on general awareness of AI operationalization a significant regression equation was found based on the degree to which they agreed or disagreed AI applications capable of performing a medical operation exist today or will exist in the future (F (4, 384) = 3.196, $p < 0.05$), with an R^2 of 0.032. Participants predicted response to whether they agree or disagree an AI application capable of performing a medical operation currently exists or will exist in the future was 0.249 + (− 0.018) when measured on a 10-point Likert scale. This indicates a negative association. As the participants' tendency to agree AI medical operations are or will be conducted, the likelihood of them associating the word "journalist" with AI decreased slightly.

Table 6 Frequencies of perception (2)

		Frequency (out of 389)	Percent
AI is a technology that requires careful management			
	Totally agree	139	35.7
	Tend to agree	180	46.3
	Tend to disagree	44	11.3
	Totally disagree	22	5.7
	Do not know	4	1.0
Ai is capable of operating autonomously after the initial programming by a human programmer			
	Totally agree	96	24.7
	Tend to agree	167	42.9
	Tend to disagree	68	17.5
	Totally disagree	45	11.6
	Do not know	13	3.3
An Ai application is capable of writing and reporting general news equal to (or better than) a human journalist			
	Totally agree	98	25.2
	Tend to agree	145	37.3
	Tend to disagree	80	20.6
	Totally disagree	51	13.1
	Do not know	15	3.9

Participants were asked to rate on a Likert scale the degree to which they agree or disagree with the statement provided

A second irregularity was found when a simple linear regression was calculated to predict whether participants would associate the word “journalist” with AI-based general awareness of AI capabilities. Two significant regression equations were found (F (11, 377) = 2.387, $p < 0.05$), with an R^2 of 0.065; one based on the degree to which they agreed or disagreed AI applications are capable of feeling emotion, and the other based on the degree to which they agreed or disagreed AI applications are capable of thinking logically. Participants predicted response to whether they agree or disagree an AI application is capable of feeling emotion was 0.413 + 0.027 when measured on a five-point Likert scale. Participants predicted response to whether they agree or disagree an AI application is capable of thinking logically was 0.413 + (− 0.033) when measured on a five-point Likert scale. This indicates that with tendency to agree an AI application is capable of feeling emotion, the likelihood of associating the word “journalist” with AI increased slightly, whereas with tendency to agree an AI application is capable of thinking logically, the likelihood of associating the word “journalist” with AI decreased slightly.

Conclusions

We have been careful in the construction of the survey to avoid any language regarding AI that would prime the participant beyond associative examples (e.g., if asked whether the participant owned a smartphone, only associative examples of brand name devices such as iPhone, Samsung Galaxy, or Sony Xperia were given). This was to ensure participants were answering questions based upon their preexisting understanding of what AI is and where it can be found. An apparent gap exists in prior literature regarding the public’s general awareness and/or perception of intelligent machines functioning in the role of journalist to produce and present news information to audiences.

The data suggests a high degree of uncertainly or generally low levels of awareness and perception of AI operationalizing in the participants’ everyday lives and more specifically in journalism and news media. While 48% of the sample could say with certainty that they had read, seen, or heard something about AI in the past year, another 40% of participants could only say it was possible and

only a quarter of participants claimed to perceive AI as capable of writing or reporting news equal to or better than human journalists. The 48% positive response rate is consistent with the 2017 Eurobarometer results. However, in 2017, the Eurobarometer only provided three options: “yes”, “no”, or “don’t know” (Special Eurobarometer 460 2017). In that survey, the positive response was 47% and 52% responded “no” (Special Eurobarometer 460 2017).

This lack of an increase in awareness since 2017 is especially interesting when considering the high rate of technology usage participants claimed. Only 30% of participants believe AI is capable of, or in development for, operating autonomous vehicles although Tesla sold between 367,000 and 368,000 of their electric vehicles in 2019[8] alone. We draw a comparative association between autonomous vehicles and Tesla automotive based on consumer-facing language in news coverage concerning their intelligent driver assistance software known as “Autopilot”.[9] The autopilot driver-assistance-software provided as an extra feature in Tesla vehicles operates on a form of AI based on “deep learning”, a version of machine learning which relies on algorithms to teach the vehicle to “think more like humans and learn how to recognize speech and images” (Korosec 2015 para. 22). We draw a simi- lar comparative association regarding smartphone owner/ operatorship. Three-fifths of the sample (61%) claimed to own smartphones, yet awareness and perception of AI in everyday operation is less than 50%. Modern smartphones operating on Apple’s iOS since 2011 or Google’s Android operating system since 2016 are also programmed with machine learning intelligent algorithms which process information internally within the device and/or connect with cloud-based AI virtual assistants (Siri and Google Assistant). The lack of an increase in awareness raises questions. Has the rate of human awareness and perception of this technology stalled in the past few years? Is the U.S. years behind European countries when it comes to awareness and perception of AI technology in operation?

[8] Tesla reached a global vehicle distribution level of 367,000– 368,000 in 2019 (Wagner, 2020).
[9] Autopilot, the system Tesla has designed for their autonomous vehicles has been in development since at least 2014 (White 2014). In an article for Wired Magazine in 2015, Musk was quoted as stating he believed “full autonomy will be here from Tesla in 3 years” (McHugh 2015 para. 24).

We recognize these forms of AI at work in medicine, autonomous vehicle development, smartphone operations, and the AI operationalized for the news media industry are separate operations with unique qualifying characterizations that distinguish their function in a society. How- ever, the focus of this research asks the general question of whether, and to what degree, people are aware of AI and how they perceive AI in operation. Attending to our care not to include language that may have primed or influenced the participant, we avoided descriptions or explanations of how any particular AI operationalization differentiates it from other operationalizations so as to best understand how participants perceive AI by their most general assumptions and whether they are aware of AI being operationalized across various industries they may come in contact with in general everyday living. Responses may expose issues of concern for how AI and its operations are described in public-facing literature.

Since mediators and intermediaries are interchangeable and, as previously discussed, source attribution in modern online communication is often reliant on the recipient's pre- established perceptions, it becomes imperative that descriptive language of the operationalization is purposefully articulated and identified. Among the possible explanations, low levels of awareness may be the effect of vague descriptive promotional language, a lack of promotional/educational descriptions of these technology products, omission of source attribution in news article bylines, purposefully vague or ambiguous identification, or a result of AI programmers generating AI applications near or at near undetectable levels. Further research into why awareness and perception remain low while saturation of AI technology into society continues to increase is recommended. New research into awareness and perception based on audience communication could be beneficial in efforts to identify causual effects of continued low levels of awareness of AI operationalization which people have come in contact with.

It is also possible that deconstructing the social definition of what it means to function and contribute to society may come into question as people reconcile with the knowledge once thought to be human-only roles in society are becoming exchangeable with intelligent machines. Research examined in the literature review

discovered people often exhibited no better than a 50–50 guess when attempting to distinguish artificial from natural generated content. In some cases, AI-produced text is indistinguishable from human composition (Graefe et al. 2018). It is possible humans are psychologically unprepared for machines that operate and function at or near human replicability and, therefore, are unable or unwilling to see AI operationalized in their lives (Stein and Ohler 2017).

Although tests revealed few instances of significance, patterns of predictability were largely maintained. Positive awareness of AI in general associations, in most cases, led to a positive awareness of AI capable of performing in journalistic and broadcast news reporting capacity. This is consistent with findings in the Eurobarometer survey wherein participants who more often showed positive associations with robots had positive, or higher, awareness levels of AI (Special Eurobarometer 460 2017). While the majority of the few significant test results appeared consistent with natural assumptions (e.g., increasing general awareness increases specific awareness), some of the findings did diverge from this normative behavior.

One significant divergence was revealed when participants equated emotion and AI with an increase in the likelihood of AI performing journalism while disassociating logic and AI with the possibility of producing journalism. This discrepancy raises questions about the fundamental association among emotion, logic, and journalism. Why does the capability of expressing emotion align with journalism while display of logical thinking does not? The purpose of this paper is not to establish causual effect, but rather to look for correlation between general awareness and perception of AI and sociodemographics and awareness and perception of AI operationalized in journalism. However, possible avenues of future research into the association participants ascribed to emotion and journalism may exist in relatively contemporary shifts in journalism away from objective news reporting towards more subjective, emotionally attached journalism. In the *SAGE Handbook of Digital Journalism* scholars assert the introduction of social media, citizen journalists, and other user-generated content has caused a shift in journalistic conventions and blurred the line between traditional journalists and audiences, claiming “emotional

expression may be a vital positive force in enabling new forms of engagement" (Witschge et al. 2016, p. 129). Future exploration into these conceptual associations would be advantageous to under- stand this association.

Another inconsistency presented when participants answered affirmatively that they believed AI is (or will be) capable of performing medical operations. A statistical likelihood exists in those who believe medical operation can (or will be) performed by AI. They also believe they had read a news story written by AI in the past 6 months. However, another test reveals that people who believe AI is (or will be) capable of performing medical operations were statistically unlikely to associate the term "journalist" with AI. In other words, people who believe AI is capable of performing medical operations believe they may have read news written by AI recently, yet they do not associate the term "journalist" with AI. We have stated that people generally exhibit no greater than a 50–50 chance of identifying artificial from naturally generated content, therefore, we should at least consider the notion that these participants who believe they have read news content generated by AI likely based that assessment off assumptions that may be nothing more than guessing. It is also possible that people generally assume medical operations are intricate procedures which require highly trained professionals in medicine and that many other professions, trades, or employment (including journalism) do not require the same level of sophisticated skillsets. A machine capable of performing a medical procedure may not translate easily to an ability to produce journalism. This would reveal a significant misunderstanding of how AI (specifically artificial narrow intelligence) functions.[10] Accuracy of a person's ability to discern articles produced by AI should not take away from the importance of this result, that these tests suggest a break at the root level between how people identify journalists from journalism (or news), or humans from intelligent machines conducting the same

[10] Artificial Narrow Intelligence (ANI) is the weakest level of the three classifications: narrow, general, and super (Kaplan and Haenlein, 2019). It is below human level intelligence, and contains all known AI systems currently in operation (Kaplan and Haenlein 2019). ANI is considered weaker than human intelligence because an ANI system cannot borrow intelligence or knowledge from memories or experiences outside of its programmed operation (Kaplan and Haenlein 2019). Within its programmed operationalization, an ANI will outperform a human assigned the same task, however, an ANI is incapable of adaptation beyond its specific program (Kaplan and Haenlein 2019).

operation. There are core questions to be addressed here. How do people define the role of journalist? How do people define a news story? Do people associate journalists with news stories? Do people identify a machine performing the same operation as its human counterpart by the same title (e.g., would a person identify an AI capable of performing medical operations as a doctor or surgeon)?

Lastly, the lack of significant findings in sociodemographic characteristics may in itself be of some significance. Age, education, and employment all had low or no significant influence over awareness and perception of AI based on our tests with the one exception of ethnicity. People who identified as Asian were significantly more likely to associate AI with news media and journalism. Based on the structure of the questions we cannot know any cultural or social significance of this result. All participants had to be located in the U.S., the survey questions and all related content was written in English, and language used (whether a participant was using English as their first language) was not asked. We cannot know whether a person who identified as Asian is an American citizen or an immigrant, or whether they are permanent residents or in the U.S. temporarily (e.g., for school or employment). We did not ask whether they may travel to (or have friends and/or family association in) another country, specifically Asian countries, or whether they speak, read and write English as their first language. The only certainty we can claim based on this finding is that ethnicity may influence awareness and perception.

This study has sought to fill a gap in existing literature which asks the extent to which people perceive or are aware of AI functioning in the role of journalism. AI is operationalized to perform many capacities across various industries. This research looks at one discrete form of AI capable of producing a finished news communication to an audience. The results of this research should not be generalized to all types of AI currently in operation in the journalism industry or across other industries.

We have determined general awareness and perception of AI is consistent with findings from 2017 that showed less than half of people surveyed are certain of encountering AI while more than half are unsure or claim they have not encountered AI. As AI is applied to specific fields and professions (e.g., medical, personal assistance, transportation, journalism and mass media), awareness of AI in

operation decreased. AI machines capable of conducting journalism or producing and presenting news media received the lowest levels of awareness and perception.

This survey was distributed in the U.S. during the summer of 2020, at a time when much of the population was forced into work-from-home and stay-at-home isolation conditions in response to a viral pandemic. Some of the questions regarded a person's office and commute experience, which both were significantly altered at this time. Improvements to the home office and general home improvement projects were reportedly on the rise during this time. Conducting this survey prior to the pandemic or months later as work-from-home experiences normalized may have yielded different results. The findings from this study are specific to a U.S. population during a remarkable period in history. Comparisons and generalization to other countries, populations, and times should be approached with caution. Considerations for developments in AI technology, public facing promotional and educational literature on the incorporation of AI in varying fields, industries, and applications, changes in populations (e.g., political and social status) should be accounted for in future research. To the best of our knowledge and ability, this study serves as a significant contribution to under- standing influences on a person's awareness and perception of AI operationalized for the production and presentation of journalism and news media.

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Declarations

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