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HOW THE SYMBIOSIS OF ARTIFICIAL INTELLIGENCE AND JOURNALISM WILL  
SHAPE THE FUTURE OF NEWS MEDIA

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## **ABSTRACT**

As artificial intelligence continues to evolve and embed itself into the daily functions of the global workforce, this thesis explores how it is leaving a lasting impact on the world of journalism from leaders closest involved with the revolution taking place. The accompanying video explores the current state of artificial intelligence in modern-day newsrooms, the limitations and challenges AI still faces moving forward, how ethics and legal factors could play a role, and how journalism might look in the future as its symbiosis with AI becomes complete.

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## Chapter 1

### AI in modern newsrooms

As journalism enters a new era of media and technology, artificial intelligence is taking center stage not just in the field of news and sports, but in all industries across the world. Over the next decade, AI will touch every profession, embedding itself into everyone's lives and day-to-day functions. Newsrooms are no exception; the symbiosis of AI with journalism, broadcast companies, and businesses in need of content will dramatically change how we interact with and consume news for the foreseeable future. The innovations in media could serve as a blueprint for how these machines and software can further develop into deeper thought process and more cognitive thinking. In this chapter, we will explore how leaders in AI, journalism and content creation startups are paving the way for the future of news and what technologies are currently being used to disrupt the media industry.

#### Augmentation and workflow efficiency

In the modern-day newsroom, efficiency and the ability to dive deeper into one's reporting are essential. As opposed to automation that generates content, augmentation assists reporters by taking care of rote and mundane tasks that a machine is capable of doing just as well as a human. Today, these kinds of strategies are being implemented with the future in mind, but not everyone is ready to get on board the self-driving boat quite yet. A survey by the Pew Research Center last year found that when asked about a future with computers and robots in the workforce, "Americans are roughly twice as likely to express worry (72 percent) than enthusiasm (33 percent)" (Smith & Anderson, 2017). Francesco Marconi, who is leading the implementation of a new editorial lab at *The Wall Street Journal*, says this resistance is natural but nothing new.

"AI is a relatively new trend but it's no different from any tech that came before it. With even the introduction of the telephone in the 1930s and the introduction of the telephone in the newsrooms what

happened was that allowed journalists to reach beyond their newsrooms and expand their field of view by being able to pick up their phone and call someone. The same argument can be made about AI, social media search, so it's this idea that humans will always be at the center of the process but they will also revert to tools to enable them do that process better and more efficiently. And so, although there's a lot of interest and a lot of buzz on AI, all of the problems, all the challenges all the opportunities, we've seen those played out in some form when other types of tech were introduced in newsrooms."

As a Strategy Manager and Co-Lead on Artificial Intelligence at the Associated Press, Marconi and his staff integrated AI technology through automation and augmentation to evolve the newsroom and make it more efficient. The result was a 12x increase in financial coverage and 20 percent of journalists' time freed up for more high-impact journalism (Marconi, Siegman & Journalist, 2017).

"The volume went up, we freed up resources, the third component was that the error rate went down," Marconi said.

*The Washington Post* also is leading news organizations into the AI era. Jeremy Gilbert, the Director of Strategic Initiatives for the *Post*, says solving workflow solutions is at the heart of their efforts.

"We looked at what our staff was spending time on that a machine could do just as well so we're constantly studying our own team, our own staff and trying to identify where are the areas of opportunity," Gilbert said. "So, what the reporters and editors come to us most about is 'I do the same thing every week, can the machine do it so I can do this other thing?'"

To do this, the *Post* has implemented several AI programs with a multitude of responsibilities. Knowledge Map augments existing stories and adds critical details and charts to supplement the content (Wang, 2015). MartyBot, named for executive editor Martin Baron, reminds writers of deadlines as they craft their work (Marburger, 2017). And Heliograf automates content at a large scale to expand the paper's volume and reach, creating nearly 500 stories for 2016 Election Day coverage and about 300 stories and updates for the Rio Olympics (FIPP, 2017).

## Automated content

Gilbert says the use of automation has expanded the breadth of their coverage and is most useful in scenarios where the potential for human coverage is low.

“When we can produce a large number of stories, even if they serve smaller audiences individually, that can make sense,” Gilbert said. “When there is an available set of data and there could be broader interest even if it doesn’t rise to the level of interest that our human reporters would cover, that too is an untapped market. We want to be able to use automation there.”

Narrativa, a natural language generation startup based in Europe and the Middle East, has also entered the automated news realm. CEO David Llorente predicts that in the next five years, 90 percent of all content online will be automated and says that mark may be met even sooner than that (48forward, 2017).

“We are producing almost 50% of the news [for our clients] in Spain. Of course, we don’t produce the main headlines, but we produce the long-tail stories,” Llorente said. “So the amount of content we generate is huge. We basically try to generate one piece of content for every reader, every person who reads our specific teams, specific currency...and we are very, very close. The only limit is the data.”

The quality is also at a high level, say both Llorente and Gilbert. In 2014, a study found readers could not tell the difference between stories written by software and human journalists, with subjects finding the bot to be more objective and trustworthy (Clerwall, 2014). Four years of technology later, Gilbert says machine-written content is held to the highest-quality thresholds just as much as human-written content in order to meet *The Post*’s standards.

An example of this can be seen in Heliograf’s 2016 Election Day coverage. Listed below are four blind online stories from *The Washington Post* (Heliograf, 2016), *The New York Times* (NYTimes, 2016), *The Denver Post* (Frank & Matthews, 2016) and *KDVR FOX31Denver* (Hickey, 2016) covering the Colorado Senate race between incumbent Michael Bennet and challenger Darryl Glenn:

<p>U.S. Sen. Michael Bennet cruised to re-election on Tuesday.</p> <p>With 63 percent of the ballots counted, the Democrat had 1,128,814 votes (49.2 percent) to 1,050,053 votes (45.7 percent) for Republican Darryl Glenn.</p> <p>The race was called just before 9 p.m.</p> <p>“Well, thank you Colorado,” Bennet said in his victory speech. “We took care of business here in Colorado tonight.”</p> <p>The race early on was expected to be hotly contested and Republicans initially targeted Bennet in an attempt to retain control of the Senate.</p> <p>But the race was never very competitive and Bennet was easily elected to another six-year term.</p> <p>Glenn, the El Paso County supervisor, was the surprise Republican nominee out of the state convention after big-name GOP would-be candidates decided not to run.</p>	<p>Democrat Michael F. Bennet has beaten Darryl Glenn, a Republican, in the race for the Colorado Senate seat currently held by Bennet.</p> <p>Republicans kept control of Senate majority, fending off what was thought to be a strong takeover bid by Democrats.</p> <p>So far, 33 Senate races have been decided, with Republicans winning 21 and Democrats winning 12. Going into Tuesday, Republicans held a majority in the Senate, with 54 seats vs. 44 for the Democrats. Two Independents in the Senate both caucus with the Democrats.</p> <p>Bennet was appointed to the Senate seat vacated when President Obama appointed Sen. Ken Salazar to be his interior secretary, and then won election in 2010.</p> <p>Glenn is an Air Force veteran and self-described "unapologetic Christian constitutional conservative." He's a Donald Trump supporter who spoke at the Republican National Convention in Cleveland.</p> <p>Colorado voted for Hillary Clinton, the Democratic former secretary of state, in Tuesday's presidential election.</p>
<p>Senator Michael Bennet won the U.S. Senate race in Colorado on Tuesday. Bennet is up by 6 points with all precincts reporting.</p> <p>Below are detailed results for the race. View other Colorado election results on our <a href="#">full Colorado results page</a>. See all races on our <a href="#">Senate map</a>.</p>	<p>U.S. Sen. Michael Bennet easily won re-election Tuesday, overpowering Republican rival Darryl Glenn to keep alive Democratic hopes of retaking the chamber.</p> <p>The outcome never really appeared in doubt as Bennet held a comfortable lead in most polls — a stark turnabout from a year ago when the Denver lawmaker was considered the most vulnerable Democratic senator in the nation.</p> <p>Bennet received 49 percent with 1,150,911 votes and Glenn took 46 percent with 1,077,783 votes with 87 percent of the projected vote counted at 7 a.m. Wednesday. The Associated Press called the race before 9 p.m. Tuesday.</p> <p>Well, thank you Colorado,” Bennet said on stage at the Democratic victory party. “We took care of business here in Colorado tonight.”</p> <p>Glenn released a statement Wednesday morning congratulating Bennet and thanking both voters and his campaign volunteers.</p> <p>“Our goal from the beginning was to protect the U.S. Constitution, create more Colorado jobs and make our country safer and stronger. I am extremely proud of our campaign and believe our message was a good one...”</p>

Ideally with an election result article, as a reader you want to know: 1) who won, 2) by how much, 3) how the result affects the bigger picture (in this case, Senate majority), 4) necessary background information, and 5) what the candidates had to say about the results.

Having said that, here are the corresponding news outlets to the above articles:

KDVR FOX31 Denver	The Washington Post
The New York Times	The Denver Post (first 6 graphs)

Of the above articles, the only byline that was not human was that of Heliograf and *The Washington Post*. To clarify, no byline could be found for *The New York Times* piece. Since it was just a short update, there is a chance the content was automated, but I was not able to confirm that.

*The Denver Post* was the only one to satisfy all five of a potential reader's needs, while *KDVR* had four and *The Washington Post* and *The New York Times* had three each if you count the links to the Senate results page for the NYT. Considering the fact *KDVR* and *The Denver Post* each have larger responsibilities to their audience to report on the race in detail than the two national newspapers, these results seem on par. The quality of Heliograf's report is on a par with the other three, especially for a machine that cannot physically attend the victory speech for a quote, but that's before even considering the most impressive part: time. Even after 17 months, the report is still more than just a placeholder; meanwhile *The New York Times* comes up short once its update is separated from the page's interactive maps. The paper also never followed up with an article after the fact, so those two graphs were the extent of the written word dedicated to Bennet's victory. *The New York Times* did update in real time, however, so at the very least they gave readers the "what" "when" it actually happened. But so did Heliograph, which constantly updated the results from every other race as they happened. Therefore, it not only updated how the Colorado senate race's results impacted the national scale in that one graph, but it updated all the other senate stories simultaneously.

All things considered, the *Post's* 2016 Election Day coverage was a success that saw a dramatic increase in the volume of their coverage, while not having to sacrifice quality to do so.

## **Personalization**

Content creators are making a hard push towards personalization in order to engage with their consumers and build a sense of loyalty. Andy Hatcher from London content creator Muuze, and formerly Reuters, stresses differentiation in a field where the content is oversaturated and true originality is harder to come by.

“Already, were finding that people write stuff and they say, ‘hey, somebody’s already written this like three years ago,’[and it’s] almost exactly the same despite the context and the time being different. They’re finding that the availability of instant history is almost narrowing the choices of what can be written, which is interesting. Which means that the writer has to become very much more focused on the added value they’re providing, not any of the background. It’s a bit like a student going into an exam with Google in their head. So, they don’t have to know any facts, they just have to know about interpreting the facts, right? So, if you’re a journalist, there’s no point of telling me the background anymore because it can probably be automated through things like Reuters, immediately find you the background to any story. All I really want to know from a news point of view is what you’re adding to that. It’s quite tough for a journalist, because they’ve either got to have a new opinion, a new angle, a new view, a new something that creates benefit for the reader, and the reader to a certain extent should be becoming more and more aware of the fact that that’s what they’re going to the news for, to get added value rather than repeat value.”

Hatcher is looking to tackle this issue and personalization through machine learning and other artificial intelligence algorithms that focus on the way news is distributed and delivered through filters.

The idea came after the Volkswagen scam of 2015 when the automobile company cheated on its emissions tests to fuel a marketing campaign on low emissions (Hotten, 2015). Unfortunately, because of the way financial news is distributed online throughout filters in Europe, some people found out about “16 months too late,” Hatcher said. Through Muuze, users can share selective personal info and the algorithm will determine what news is relevant and not, giving customers news relevant to them and allowing content producers the opportunity to reach the people they need to.

Gilbert says as consumers become more accustomed to music and video recommendations for apps they use, *The Washington Post* looks to do the same with their articles so they can learn more about the readers and keep them around longer.

“Can we get ever more personal? Can we look at browser histories? You know if they read series of our articles written on Syria then maybe we don’t have to give them background on the news of the day. We just need to tell them what happened and they’ll have more time to read an additional article about something else,” Gilbert says. “So, we’re certainly spending a lot of time thinking about, you’re reading one article, what can we do to make sure that of the three-to-four hundred articles that we publish a day, the next thing we recommend for you is very interesting because driving up that recirculation rate that we have suggests we have a much stronger relationship with an individual.”

## **Fact-Checking**

Not all online content has the reader’s benefit in mind, however, as “fake news” continues to test consumers’ trust in traditional media companies. According to a poll in March by Monmouth University, 77 percent of people believe traditional major newspaper and TV news sources at least occasionally report fake news stories, which is up from 63 percent last year (Monmouth University Poll, 2018). This divide in understanding what is news and what is not even expands into sponsored content, which can often look like news but is meant to push a certain product or message. Also, a 2016 Stanford study that

tested nearly 8,000 students ranging from middle school to college found more than 80 percent of middle school students could not identify the difference between “sponsored content” and real news (Wineburg, et al, 2016).

FightHoax is the world’s first AI algorithm that can fact-check news articles in seconds. George Kary, FightHoax’s Head of Operations, says their goal is to use AI to help both newsrooms and readers identify fake news more clearly.

“Information, from our point of view, is the right of both content creators and information consumers. Either if you create content or just read content you have the right of fact-checking and understanding the small letters of every news piece.”

The algorithm takes URLs from online news sources and gives users a multitude of data: the author’s background of past statements, potential motivations for bias, an emotion chart, and related sources to cross-check the data, all of which gets weighted depending on the scenario to give the most accurate results.

While the algorithm is still in a private-beta phase, it claims an accuracy of 89 percent (FightHoax, 2017). In a world where falsehoods are “70% more likely” to be shared on social media than factual news (Vosoughi, Roy & Aral, 2018), Kary says it’s important to understand where biases might come from and that the tool is meant to assist your critical thinking, not replace it.

“The content we are analyzing is created by humans, the algorithm that analyzes the content created by humans was created by humans, and so forth,” Kary says. “So, our whole approach and whole technology is based on the fact that human error, human perception and human intervention are parts that we cannot circumvent, so we take proactive measures in ensuring we are transparent, and that both our consumers and users understand that we cannot achieve a level of perfection or that our algorithm and the results you see can replace your critical thinking. So, at the end of the day, we’re just helping you understand the world a little bit better.”

## **Cognitive engine combination**

As more newsrooms, broadcast stations and other media outlets begin to adopt these technologies, Marconi says companies will need to first address their needs to make sure they apply to their mission and goals.

“People tend to think of technology first and then what that tech can enable. The reality is that understanding the problems and key points in newsrooms is actually the biggest challenge,” Marconi says.

While most cognitive engines can accomplish narrow tasks with efficiency, John Ward of Veritone says it can be a limitation when it comes to tackling bigger problems.

“If you train an engine to play ‘Go,’ that’s fine and good, but if you present a checkers board or chess board in front of that same cognitive engine, of course it can’t do it because it ultimately fails because it’s only trained for one thing,” Ward says. “So, our thesis, and again it’s been proven out, is that if you marshal and combine multiple types of cognitive engines together such as computer vision, as well as natural language processing, redaction or etcetera, you can solve wider problems by using multiple engines in concert and in parallel.”

Veritone works with companies like iHeartMedia and ESPN, providing services like real-time framework to process audio and video in seconds, as well as workflow solutions, topic assessment, and talent development for broadcasters. Ward says these types of services not only help companies optimize their content, but also help them monetize it by repackaging available data for further use.

“For example, major sports leagues have years and years and some case even 50 years of game footage and interviews and what ends up happening with that content is someone has to actually sift through it to see if it has value and how you can potentially remonetize it a second, third, and fourth time, and in order to do that they’re running up against a large wall of ‘we don’t have enough eyes in our company or maybe even in the world to watch all that footage and understand what metadata is within and how do we search for and discover and use it moving forward,’” Ward says.

## Chapter 2

### Concerns with AI and algorithms

While the artificial intelligence boom continues to shake up industries, skepticism and fear remain a part of the discussion of its impact on the future. Whether it's the uncertainty of the future job market, algorithm bias, privacy concerns, or issues with following legal and ethical standards, journalists and media companies will have to take some concerns into account.

#### AI and job replacement

The most debated of these potential issues is how artificial intelligence will affect the employment of human journalists. One study lists media jobs in “the low risk category” for potential of future robot replacement (Frey & Osborne, 2017). Yet, automation has already taken over data-driven types of reporting (like sports and finance) and continues to become more sophisticated by the day. Marconi suggests there is “valid concern” for any industry but that the goal in journalism is not replacement but efficiency, which can mean even more jobs in the future.

“It can automate human production, but it can't replicate human curiosity and intellect and creativity,” Marconi says. “Another component of that is there are new jobs being created because of AI, so there are roles like automation editors, people that focus on the implementation of new technologies and really think about it from an editorial standpoint. There's computational journalists that use machine learning and other computer science techniques to do research and investigation. There are newsroom tool managers that are responsible for looking at how to use all of these software and tools to make the production more differentiated and increase volume.”

According to Gartner Inc. (2017), 1.8 million jobs will be lost due to artificial intelligence by 2020, but during that same time span it will create 2.3 million jobs, for a net gain of half-million jobs to the marketplace.

Llorente agrees that while jobs will be lost, journalists are required to do things that machines simply cannot do.

“The biggest gap between human journalists, or real journalists, we are seeing is the data,” Llorente says. “There are things you cannot find in the data...it’s not there basically. Either because we don’t have this data because the data doesn’t contain everything on the certain topic, or because it is really hard to extract this information because it’s maybe a sentiment or an opinion, and this is the biggest gap for me. And that’s certainly very beautiful. There will always be a need for journalists, between this gap, because I don’t think we have everything within the data that we need.”

### **Algorithmic bias**

Algorithmic bias is being addressed in modern algorithms because it makes a big difference in how cognitive engines operate. Bias is unavoidable and present in all programming and data, and it will show in the machine’s actions, which can often fail spectacularly. One such case is Microsoft’s chatbot gone racist. Within hours of Tay’s release, its “repeat after me” feature was exploited by internet trolls as they got the bot to support Hitler and deny the Holocaust (ABC News, 2016). Google also received backlash for its Photos recognition app’s misidentification of a black woman as a gorilla, causing Google to eliminate tags to relating primates (Complex News, 2015). When one considers the fact that large numbers of AI systems have been trained on the publicly available Enron email database, it is clear that recognizing potential biases is a crucial part of the AI integration process. While those engines might have a rich bank of data to pour through to learn human language, they’re also learning corruption and how to hide an “extramarital affair,” things companies, media or otherwise, likely would not want seeping into their AI content (Leber, 2014).

“How do we make accountability and transparency which is a new field of journalism,” Marconi says. “From how you get credit scores to how courts make criminal selector sentences, a lot of those

things around our lives are dominated by algorithms and someone needs to report on them and understand their processes. And journalists are serving as sort of the advocates for that accountability and for that transparency of machines,” Marconi says.

“I think the key to having unbiased objective reporting, which is a hallmark of the *Washington Post*, there’s two things; one, being definitely on guard for anything that might not meet that threshold, and two, making sure we have a very diverse staff who are writing our stories and building the systems and tools that can also themselves write stories,” Gilbert said. “So, when you have, especially in news, a newsroom that does a good job at reflecting the population you cover and the population that is consuming your journalism, it really helps ensure that objectivity and fairness in your coverage.”

### **Other legal and ethical issues**

One of the defining characteristics of journalism is adherence to a code of ethics. With AI, however, there is no protocol for machine behavior, and ethics cannot be programmed into an algorithm. Thanks to social media platforms and the internet, there is more data available than ever before, but just because data is there doesn’t necessarily mean it is either legally or ethically available. Marconi lays out a level of culpability for journalists who should be aware of what their machines are actively doing.

“The news industry is quickly adapting to it and realizing that the journalist is no longer only responsible for the output that is the story but is also responsible for the process behind news gathering, processing and distribution which is also controlled by algorithms,” Marconi said. “The journalists are the ones creating these templates and what the technology does is matching these data with the templates automatically and then producing this story. So, the role of the journalist there is very clear, it’s to make sure that these templates follow editorial standards and guidelines. And then before producing these automated stories, there’s a process of quality control which is very similar to, or it’s the same as any

quality control of a human-written article. So those standards are very well-defined for the first machine meaning when a story's automated or augmented by a computer."

Another aspect of the ethical conversation is maintaining the privacy of those who you gather personal information from in order to provide personalized content. Especially in the wake of a massive Facebook scandal with millions of users' data compromised (Lapowsky, 2018), Hatcher says transparency is key and is something he implements with Muuze.

"Everything is in control of the user," Hatcher says. "So, they could offer up or restrict as much data as they like, and we offer effectively to a user the ability to view exactly what we are using. There's no anonymizing of personal data in terms of if we use anything in your social profiles you can see exactly what it is, and then if you don't like it you can restrict it, and you can remove the history of what we have viewed as well. It's totally traceable and (inaudible) in that sense, but easy enough. We did that when we set it up, so we've come from a kind of background of clarity and transparency so I think there was always a sense that not letting the user know what we were using it for was always gonna be a bad idea."

## Chapter 3

### A future with AI

A future where AI and journalism have come to a complete symbiosis is one filled with both uncertainty and innovation, fear of change and hopeful promise. Five to ten years from now, journalists may not have to leave their to start the day as drones go out and collect information (Marconi, Siegman & Journalist, 2017). . It's also possible the profession will not be all that different and journalists will just have a lot more time-saving technology and tools at their disposal. The only thing that is certain is that AI's integration with journalism is no longer science fiction, it's a foregone conclusion. The only questions are to what extent and at what rate that change will occur, as well as what hurdles lie ahead ethically, legally and morally.

The following are a few final thoughts on what journalists should look forward to and consider in the future:

- **A code of ethics is needed for algorithms just as there is for reporting.**
  - o A code similar to the SPJ Code of Ethics is necessary for handling these algorithms in order to make an attempt to curb bias.
- **Transparency in algorithms, personalization technology is absolutely essential.**
  - o The more open one is with one's processes, the more trust and loyalty will be gained from cautious readers/subscribers.
- **Journalists will soon need to know the technology part of the job just as much as the reporting part.**
  - o Understanding the AI you are working with will soon not just be beneficial, but necessary for journalists. Start learning how to code.
- **Siri and Alexa will soon be your co-workers.**

- Voice interface technology was a common answer as the next big newsroom innovation.

It will likely work both as a personal AI assistant for journalists as well as a way for audiences to locate and digest content tailored for them in real time.

- **Journalism will not and cannot become completely automated.**

- As talented as robot journalists may become, there are too many human factors involved in quality news reporting process for total human replacement.

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## ACADEMIC VITA

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**Academic Vita of Ryan Berti**  
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### Education

Major(s) and Minor(s): Major in Broadcast Journalism, Minor in Sociology  
Honors: Journalism

Thesis Title: HOW THE SYMBIOSIS OF ARTIFICIAL INTELLIGENCE AND  
JOURNALISM IS SHAPING THE FUTURE OF NEWS MEDIA

Thesis Supervisor: Curt Chandler

### Work Experience

Feb 2015-Present

Production Director, Editor, Broadcaster

Ran production department, oversaw CommRadio's 30+ talk shows and Penn State sports broadcasting events, edited articles and led writing staff

CommRadio – 103 Innovation Blvd., State College, PA 16803

Jeff Brown

Aug 2016-Present

Lubert lab consultant

Assisted students on projects, looked over the audio labs, studios and equipment

Penn State College of Communications - 103 Innovation Blvd., State College, PA 16803

Steve Reighard

Grants Received: N/A

Awards: N/A

Professional Memberships: N/A

Publications: N/A

Presentations: N/A

Community Service Involvement: N/A

International Education (including service-learning abroad): N/A

Language Proficiency: English, Spanish