# ETHICAL CHALLENGES OF ALGORITHMIC JOURNALISM

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# ETHICAL CHALLENGES OF ALGORITHMIC JOURNALISM

**ABSTRACT**

*With the institutionalization of algorithms as content creators, professional journalism is facing transformation and novel ethical challenges. This article focuses on the concept of Algorithmic Journalism on the basis of natural language generation and provides a framework to identify and discuss ethical issues. The analysis builds on the moral theories of deontology, utilitarianism, virtue ethics, and contractualism and remaps the ethical discussion for Algorithmic Journalism at the intersection of digital media ethics and cyberethics. In order to capture the whole range of potential shifts and challenges in journalism ethics the article combines the ethical multi-layer system of responsibility by Pürer with the classification of journalism by Weischenberg, Malik, and Scholl on an organizational, professional/individual, and social/audience sphere. This analytical framework is then complemented with attributes derived from the technical potential of Algorithmic Journalism. As a result, the analysis uncovers new ethical challenges and shifts of responsibility in news production for journalism practice and journalism research at the levels of objectivity, authority, transparency, and at the level of implicit or explicit values.*

## Changing Journalism

Journalism and its production routines and conditions have always been shaped and influenced by technology (Pavlik 2000; Parry 2011). With algorithms entering the stage of professional news production, distribution, and consumption, editorial structures and journalistic routines are changing significantly (Napoli 2014; van Dalen 2012; Pavlik 2013; Broussard 2014). Along these technological and social developments, values and responsibilities assigned to journalism and journalists are changing accordingly (Brosda 2010; Culver 2016; Meier 2002, 117f.). Due to the progress in natural language generation (NLG) – an area of research in computational linguistics – large numbers of texts can be produced automatically from digital structured data (Reiter and Dale 2000). For example, the Associated Press (AP) uses this technology to automate their corporate earning stories with Wordsmith, a software tool developed by Automated Insights. This phenomenon of automated algorithmic content creation and its application and use in journalism is here conceptualized as Algorithmic Journalism (Dörr 2015). Terms like robot journalism, automated journalism or machine written journalism are often used similarly (Anderson 2012; Carlson 2014).

With algorithms entering professional news production, ethical challenges arise on various levels. They are detected on the level of data search and origin (Bradshaw 2014), algorithmic authority (Carlson 2014), algorithmic objectivity (Gillespie 2014), algorithmic transparency (McBride and Rosenstiel 2013), data usage and abuse (Zion and Craig 2014), and on the level of values and reasoning embedded in code (Kraemer et al. 2011; Young and

Hermida 2014). Diakopolous (2015) also discusses ethical challenges of algorithmic accountability with a focus on reporting.

There have been discussions about ethics of cybertechnological systems in general (e.g. Kernaghan 2014; Friedman et al. 2008; Tavani 2011; Spinello 2011), as well as in specific fields of application, e.g. high frequency trading (Davis et al. 2012) or autonomous vehicles (Lin 2015). These cybertechnologies can be distinguished from other (precedent) computer technologies as they are uniquely fast, uniquely complex, uniquely coded, uniquely universal (global), and uniquely ubiquitous (see Tavani 2011, 4; Ess 2009). These features also apply to Algorithmic Journalism (see Dörr 2015 for the technological potential).

Still, there has not yet been a consistent remapping of media ethics and journalism ethics focusing on this phenomenon (see Prinzing et al. 2015 for an overview). Therefore, RQ1 addresses the question:

> **RQ1:** Where can the ethical challenges of Algorithmic Journalism be theoretically located?

This article then provides a framework to identify and discuss the ethical issues of algorithmic content generation in journalism.

To outline and structure the whole range of shifts and challenges in journalism ethics, the framework is theoretically based on Weischenberg, Malik, and Scholl´s (2006) classification of journalism as a social, organizational and professional sphere. This structuring is then combined with the ethical multi-layer system of responsibility by Pürer (1992) to journalism ethics. To identify the relevant levels of ethical challenges before, during, and after news production, this analytical framework is also complemented by attributes derived from the technical potential of Algorithmic Journalism.

> **RQ2:** Which ethical challenges of Algorithmic Journalism can be identified along the organizational, professional, and social sphere?

**Ethical Localization of Algorithmic Journalism**

To answer RQ1, the following chapter illustrates the theoretical localization of Algorithmic Journalism within ethical concepts.

Generally speaking, ethics is a subarea of philosophy dealing with the morality of human action (Prinzing et al. 2015). Morality as "a system of rules for guiding human conduct, and principles for evaluating those rules" (Tavani 2011, 36) and ethical behavior should lead to the common wellbeing of all. Therefore, four moral theories help to analyze and cluster argumentation in ethical disputes. First, there are consequence-based ethical theories like utilitarianism (Bentham 2015, orig. publ. 1825; Mill 2006) asking what leads to the greatest amount of good for the greatest number of people affected by an action. Second, duty-based approaches of deontology going back to Kant (2003 orig. publ. 1797) and Ross (2003 orig. publ. 1930) are arguing that morality is based on the duties and obligations of human interaction. Third, contract-based theories relying on Hobbes' Leviathan (Darwall 2003), are speaking of establishing moral systems through societal contracts. Finally, approaches of virtue ethics (e.g. Aristotle 2003) focus on the character of a person asking, "What kind of person should I be?". These moral theories help to capture ethical issues in journalism ethics in general and when dealing with Algorithmic Journalism in particular. A similar approach was

suggested by Annany (2015) by combining deontology, utilitarianism and virtue ethics while describing the application of these theories as being restricted to certain areas. In his understanding, deontology is solely found in policies and regulations, utilitarianism in technology development, and virtue ethics only on an individual level. But when discussing journalism ethics and the influence of automated content production, we argue for a broader approach. As Ananny´s (2015) analytical model for algorithmic applications focuses on ethical questions of when, how, and for whom, this analysis also takes questions of source (by whom?) and motivation (for which reasons?) into account.

As ethical challenges have always been part of media research (Hömberg and Klenk 2014; Brosda 2010; Ward 2006), traditional media ethics are a form of applied ethics focusing on the professional mass media system with its daily routines and professional practices (Horner 2013, 5). Media ethics usually do not develop synchronously with the technological and social development in journalism. Overall, ethical discussions often arise after negative events and hardly as a proactive examination of possible conflicts (Horner 2013).
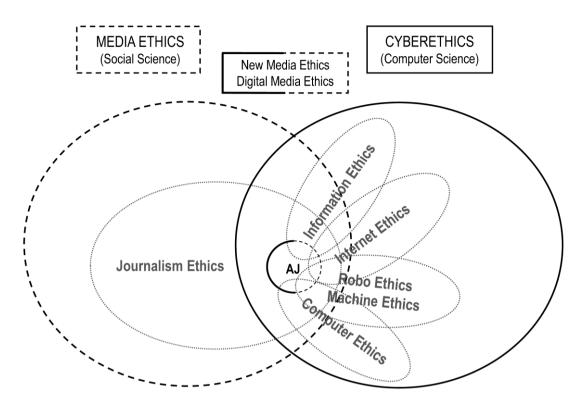
New developments like networked technologies, new intermediaries, the deprofessionalization in journalism, or new working routines established in the light of the Internet and technological change are usually tagged with the terms "new media ethics" (Debatin 2010) or "digital media ethics" (Ess 2009). The term "new media ethics" remains unsatisfactory: First, the term "new" is time-dependent; e.g. in the 1950s, TV was new, but that does not apply today. Even the Internet as a primary object of new media ethics is not "new" as it is a widely diffused and applied technology (Debatin 2010, 318). Second, "media" still mostly refers to mass media although new technologies do not need to have the same features. Insofar the term "digital media ethics" coined by Ess (2009) seems more promising for the ethical discussion of Algorithmic Journalism as it focuses on technological core-features and does not rely on a description of a technology's innovative status.

Following this general classification, media ethics in social sciences are recently influenced by applied fields of cyberethics in computer science (Maner 1996; Spinello 2011). This term refers to the study of moral, legal, and social issues involving cybertechnologies, such as privacy, property, free speech etc. which can be understood according to Tavani as "specific expression of core (traditional) moral notions, such as autonomy, fairness, justice, responsibility, and respect for persons" (2011, 11).

Within cyberethics, other applied fields of ethics have to be considered for the ethical discourse on algorithms in journalism and especially for Algorithmic Journalism. These are in particular "computer ethics" (Pierce and Henry 1996; Johnson 2009) which are referring to moral issues concerning computing, as well as "information ethics" (Capurro 2007) referring to moral issues concerning the flow and the processing of information. Furthermore, "Internet ethics" (Langford 2000) dealing with ethical issues concerning the Internet and focusing on connectivity and the technological fundamentals, or more recently, "machine ethics" or "robo ethics" (Shulman et al. 2009; Borenstein and Pearson 2012) referring to securing the ethical behavior of artificial intelligence systems and agents have to be included. This structuring is closely linked to the discussion of algorithms as relatively autonomous actors with delegated (moral) agency (Just and Latzer 2016).

The analysis of Algorithmic Journalism's ethical implications is therefore situated in the overlapping fields of digital media ethics – as a part of journalism ethics – and cyberethics. Figure 1 illustrates the localization of Algorithmic Journalism in the ethical field and highlights RQ1.

*Ethical localization of Algorithmic Journalism*



Journalism has been one of the first and best elaborated areas in media ethics (e.g. Groth 1930). Within this field, the social and technological development of journalism shape the discourse which ethical and moral claims are made and what journalism should accomplish for society (Brosda and Schicha 2010).

Throughout this evolution, various values were inscribed into it. At the very beginning, journalism was seen as mere reporting – reproducing facts without editorial interference (Brosda 2010, 259ff.). The major goal was to provide information. Values such as objectivity, neutrality, confirmability, and the role as intermediary were developed. Through social uprisings in the late 18th and early 19th century a new interpretation of journalism was established: the expatiating journalism. Journalism should illuminate society, find the truth, criticize the potentate, take a stance, and help to build an opinion. The idea of freedom of opinion and the press were established as well as advocacy for minorities. In the tradition of illumination investigative journalism was developed, highlighting values of truth and eliminating abuses as well as the protection of sources (Brosda 2010). In the first half of the 20th century another branch evolved: the interpretive journalism (Selgado and Strömbäck 2012) – balancing between reporting and expatiating and trying to compensate differing moral values of objectivity and forming the public opinion.

In the second half of the 20th century a phase of consolidation of journalism began, i.e. ethically reflected and embedded professional routines evolved on an organizational level. Examples are ethical press codes, e.g. the German "Pressekodex" from 1973, or the international IFJ Declaration of Principles adopted in 1954 (IFJ 2015).

This phase ended through new technological developments by the beginning of the 21st century. Kovach and Rosenstiel (2007) state therefore that the traditional "journalism of verification" with its rigorous fact checking is being displaced by deprofessionalized forms of journalism. First, "journalism of assertion" is going back to a mere reporting tradition with

little investigation done by the journalist but only enriching existing facts with background information. Parallel, "post-fact" or "after-the-fact checking" journalism evolved (Shirky 2014, 15ff.). Values like scrutiny and correctness therefore suffered. Second, "journalism of affirmation" is primarily providing opinions. Values such as objectivity and advocacy for the weak or the public collide. Third, with "journalism of aggregation," algorithms are finally introduced. They scan various online resources (news agencies, websites, blogs, PR agencies) for content without fact checking, proofing reliability of sources, or paying for the content. Values such as reliability and correctness are affected, and moral rules such as "You shall not steal" are broken (Debatin 2015).

Although questions of data search and origin (Bradshaw 2014), algorithmic authority (Carlson 2014), algorithmic objectivity (Gillespie 2014), data usage and abuse (Zion and Craig 2014), reasoning (Kraemer et al. 2011; Young and Hermida 2014), transparency (McBride and Rosenstiel 2013), and accountability (Diakopolous 2015) were already part of scientific discourse of algorithmic applications, ethical challenges of Algorithmic Journalism have not yet been framed and analyzed.

Focusing on the latest research in journalism ethics (McBride and Rosenstiel 2014; Prinzing et al. 2015), traditional challenges like objective reporting, venality, the separation of fact and fiction, PR or advertisement as well as the correctness of reported facts, respect for privacy and copyright, or the application of appropriate research methods also have to be discussed within the context of an automated content creation and its use and dissemination in professional journalism.

**Analytical Framework**

The following part outlines the analytical framework to uncover the ethical challenges of Algorithmic Journalism on various levels.

As there is a strong tradition of virtue-based ethics at the micro-level in journalism ethics, this line of thinking states that the journalist as an individual has a very strong responsibility for acting morally. He/She should have a diligent, reliable, honest, and trustworthy character and act with discernment. These virtues are often seen as given or to be primed in journalistic education (Hömberg and Klenk 2014).

Common criticism expressed the strong tradition of individual ethics in journalism ethics due to the strong differentiation of the media system and that it is hardly possible to make a single person responsible for a certain outcome. Furthermore, professional journalists may be exposed to external constraints (economic, hierarchical) that sometimes prevent moral action (see the concept of corporate responsibility in media ethics; Funiok 2011; Kraemer et al. 2011). This critique also applies to Algorithmic Journalism as there are multiple actors and different levels of responsibility during news production visible. Therefore, this article identifies ethical challenges for media organizations, professional journalists, service providers, programmers, data providers, and the audience on an organizational, professional, and social sphere.

Even as there are various attempts of systematizing journalism ethics, e.g. by Pöttker (1999) with his three imperatives of separation, Thomaß's (2003) five ethical principles of journalistic practice, or Haller's (1992) classification along various value structures, the multi-layer system of responsibility introduced by Pürer (1992 referring to Speamann 1977) is on a more abstract level. Besides the individual level, it also takes the media system and the audience into account.

Following Pürer´s approach to analyze the ethical challenges of Algorithmic Journalism on different levels, the framework is complemented by the classification of journalism according to Weischenberg, Malik, and Scholl (2006). For an institutional understanding of journalism, it is structured into an organizational, professional, and social sphere. On a social level, journalism fulfills certain tasks by observing parts of society and providing the public with relevant information. This includes fact-based products with a certain reach (Weischenberg, Malik, and Scholl 2006, 346) as well as products of special interest (Rühl 1980, 382). Journalism is traditionally produced on the organizational level within media organizations according to specific rules and routines or by other journalistic actors on a professional level (Wolf 2014, 66; Hohlfeld 2003, 127). It is essential for this theoretical understanding that media organizations are seen as institutions, which fulfill specific functions for society (Weischenberg, Malik, and Scholl 2006, 347). The ethical analysis will show, that there is an evident shift of functions and challenges within these spheres.

As mentioned above, the levels identified by Pürer (1992) are similar to those of Weischenberg, Malik, and Scholl (2006) and therefore are able to frame the ethical discussion in all its range:

First, the level of individual ethics relying on the moral of the individual journalist is reflected in the professional sphere. It also refers to legal regulations as well as press codes, e.g. the requirement to fulfill the principles of objective, transparent, and accurate reporting as well as appropriate research methods (on the governance of algorithms, see Saurwein, Just, and Latzer 2015). Of course, individual ethics in the professional sphere are shaped and influenced by organizational, societal, and cultural structures as well as professional and individual principles of journalistic work. In Algorithmic Journalism these principles are embedded within code, with journalists and coders working together to fit the product to individual and organizational ethical standards. We argue that in Algorithmic Journalism (moral) human agency is partly delegated to algorithms. In terms of algorithmic reality construction Just and Latzer – referring to Mitcham (2014) – note that "agency is not only imposed, as in traditional mass-media technology, but predominantly delegated, allowing limited algorithmic intentions and autonomy" (2016, 18). In addition, they conclude that this degree of complexity in the cooperation between journalists and algorithmic agents evokes ethical challenges (e.g. low transparency, controllability, accountability) (Just and Latzer 2016, 18f.). Albeit in alleviated terms, individual ethics are in play as the journalist is in hierarchical control of the final product and is constantly able to adapt the software or change the underlying data set if ethical issues arise.

Second, the level of the media system extends individual ethics to a specific perspective of tiered responsibilities of legislators, media staff, and media owners. This also reflects the structure of society, politics, economic demands, and hierarchies within media organizations that are mirrored in the organizational sphere.

Third, Pürer ascribes an ethical responsibility to the audience since journalistic production is influenced by public demand. The audience has the power to dismiss specific journalistic products (economic power). This level can be combined with the social sphere. Nevertheless, the different levels of responsibility cannot be clearly separated from each other as the example of press codes show: They reflect standards for working routines of the individual journalist, but they are also incorporated at an organizational level (the corporation or the industry).

For further analysis, this multilevel framework is also embedded in the grand moral theories of deontology, utilitarianism, contractualism, and virtue ethics – as pictured above – as they are helpful in discussing specific ethical problems of Algorithmic Journalism (table 1).

*Framework for the ethical analysis based on Pürer´s multi-layer concept of responsibility (1992) and spheres of journalism by Weischenberg, Malik, and Scholl (2006)*

| MORAL THEORIES | | |
|---|---|---|
| **Organizational Sphere** | **Professional Sphere** | **Social Sphere** |
| **Ethics of the Media System** | **Individual Ethics** | **Ethics of the Audience** |
| - Tensions through Hierarchy<br>- Economic Aims | - Objectivity<br>- Transparency<br>- Accuracy<br>- Respect for Privacy<br>- Appropriate Methods of Research<br>- Separation of Fact & Fiction | - Media Education<br>- Control of Demand |
| FRAMEWORK | | |

As journalism has to face ethical challenges arising with new technologies, it is valuable to identify possible areas of conflict from a technological view. The attributes derived from the technical potential of Algorithmic Journalism are therefore linked to the framework of Weischenberg, Malik, and Scholl (2006) and Pürer (1992).

**Ethical Challenges Derived from Technology**

Algorithmic Journalism is here defined as "the (semi)-automated process of natural language generation by the selection of electronic data from private or public databases (input), the assignment of relevance of pre-selected or non-selected data characteristics, the processing and structuring of the relevant data sets to a semantic structure (throughput), and the publishing of the final text on an online or offline platform with a certain reach (output)" (Dörr 2015, 3).

The starting point for NLG is a data base, for example sports, financial, weather, or traffic data. This data can be accessed via cloud or local memory. Then, it is processed according to predefined linguistic and statistical rules to a text in natural language (for an overview see also Carstensen et al. 2010). The processing is also possible via cloud access or a local copy of the software. Because the result in the form of a text, e.g. the latest match summary of a football game, has to be pre-set in the code, the generation process – the actual "writing" – as well as most of the publication process (output) is almost completely automated without human interference. The final stage of publishing depends on the implementation of the software within content management and online publishing systems of a media organization (on the technical potential see Dörr 2015).

These changing processes in news production are leading to shifts in journalistic functions and evoke ethical problems which are now addressed (see table 2 for an overview).

Based on the technical premises, we are able to identify upcoming challenges before (input), during (throughput), and after (output) content generation along the spheres of journalism and ethical layers of responsibility.

First, ethical issues are identified at the input-level concerning data. As structured data is a precondition of NLG and its journalistic use, questions about data origin occur. The data has to be reliable and accurate. This can be evident for e.g. financial reporting, when incorrect share prices are reported based on false data. Software is always able to do erroneous reporting based on poor coding or data sources. As NLG is not yet able to be creative or self-learning (see Reiter 2010), there still is a human element in Algorithmic Journalism in terms of coding.

> "In a story Aug. 5 about Graham Holdings Co. earnings — generated by Automated Insights using data from Zacks Investment Research — The Associated Press reported incorrectly that Graham Holdings shares had fallen since the start of the year and a year ago. Adjusted for spinoffs, its shares are up about 33 percent this year and 62 percent from a year ago." (Fox News 2015)

Another question is if there are missing data or items in disorder that limit the information value of the data set. Missing items can lead to biases during content generation as it is only possible to process the information displayed in the data base. Does the data meet the prerequisite of objectivity? Is it possible to report the whole story? Where does the data come from? Who collected it? How was it collected?

Traditionally, source protection is of high relevance in journalism. With Algorithmic Journalism, it is questionable if source protection is possible or even desired as service providers and their journalistic clients should disclose all data sources in terms of data transparency (Ward 2014). Another important question is whether personal and/or privacy rights are infringed when collecting data. Therefore, questions of data origin and quality were once situated at the individual level of responsibility in traditional journalism. Now, this responsibility shifts to the management level of media organization or third parties as they decide which data is used for their product. Issues of data rights and authority also arise. Due to the complexity of programming, NLG is often outsourced to specialized companies like Automated Insights or Retresco. This leads to questions about data processing. Do media organizations have the right to process the data and use the generated texts for commercial use (copyright)? In addition, media organizations in journalism often deal with economic constraints questioning the underlying imperative: Collecting data and meeting journalistic values vs. processing data for commercialized products?

As Algorithmic Journalism is only possible within programmed semantic structures and pre-set rules, questions about code are also evident at the input level. Does the code reflect journalistic values of media organizations such as transparency, objectivity, responsibility, and accuracy? For example, it took the Associated Press (AP) one year to match the software with its own writing style (ASBPE 2015). How difficult is it then to inscribe ethical values for different and more complex products of Algorithmic Journalism? Are media organizations able to understand programming and are they able to disclose the relevance and source assignment to public demand? Furthermore, as the major goal of a coder is to solve a certain problem and to "make it work," the engineer´s working routines have to be reshaped. Journalistic values thus should be embedded in code (Del Campo et al. 2013). To adapt code for an ethical use in journalism, Friedman et al. (2006) therefore propose a value sensitive design. According to the authors, a "value sensitive design is a theoretically grounded

approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design process." Here, responsibilities also shift from the individual level to the level of the organization or third parties.

In throughput, media organizations take over production authority. They also have to address questions of authority and transparency like data source disclosure, disclosure of automation and code as well as legal accountability on the output level (for legal issues of automated content in the United States, see Weeks 2014). So far, AP tags their texts with a special line that they were generated by Automated Insights using data provided by Zacks (AI 2015). But as Dörr states, there are other journalistic entities that are not labelling automated content (2015, 14).

Formerly, the option of publishing anonymously was a basic precondition for protecting sources or the journalist from prosecution. Nevertheless, this collides with other values such as transparency and accountability. If the audience should fulfill a moral responsibility (social sphere), it is important whether sources and authors are visible or not. If there is no information on the algorithmic nature of a text and its resources, how should the audience make a decision whether it wants to consume the information and whether it can rely on it? Therefore, information asymmetries arise. Recent empirical findings suggest that the audience cannot fulfill its moral responsibility because it can hardly distinguish unmarked journalistic content created by human journalists from algorithmically created content (e.g. Graefe et al. 2015; Clerwall 2014; van der Kaa and Krahmer 2014). Furthermore, the audience is not able to decide whether the provided information is correct or has a statistical bias. Since the audience is controlling the demand and shape of Algorithmic Journalism, it decides the topics of observation (see also data diversity for an observation of society as a prerequisite on the input level).

In the professional sphere and due to functional shifts, journalistic actors have to face the same issues as media organizations regarding code structure. In throughput and output questions of authority arise: Who is monitoring the machine/software/code if errors occur during production? AP, for example, has stopped monitoring every single generated text for their earnings reports as it is too time consuming (Turi2 2015). This monitoring is also relevant on the output level as results are often published autonomously by the system (ASBPE 2015).

As it is not possible to illustrate the many layers of ethical issues within this article, Table 2 structures the ethical challenges of Algorithmic Journalism and provides a starting point for further research.

| MORAL THEORIES | | |
|---|---|---|
| **Organizational Sphere** | **Professional Sphere** | **Social Sphere** |
| **Ethics of the Media System** | **Individual Ethics** | **Ethics of the Audience** |

| | Organizational Sphere / Ethics of the Media System | Professional Sphere / Individual Ethics | Social Sphere / Ethics of the Audience |
|---|---|---|---|
| **Input** | DATA<br>• Data Origin:<br>  - Reliability (Accuracy)<br>  - Objectivity<br>  - Responsibility<br>  - Respect for Privacy<br>  - Appropriate Methods of Data Collection<br>  - Bias<br>• Data Rights / Data Authority<br>• Economic Aims<br><br>CODE<br>• Code Structure:<br>  - Transparency<br>  - Objectivity<br>  - Responsibility<br>  - Accuracy<br>  - Bias<br>  - Machine Communication Optimization<br>• Code Rights / Code Authority:<br>  - Responsibility<br>• Economic Aims | CODE<br>• Code Structure:<br>  - Transparency<br>  - Objectivity<br>  - Responsibility<br>  - Accuracy<br>  - Bias<br>  - Machine Communication Optimization | DATA<br>• Data Origin:<br>  - Data Diversity for Observing Parts of Society |
| **Throughput** | • Production Authority | • Software / Code Testing & Monitoring | |
| **Output** | • Result Authority<br>• Transparency:<br>  - Disclosure Data Source<br>  - Disclosure of Automation<br>  - Disclosure of Code<br>• Legal Accountability | • Result Monitoring Causing Authority | • Transparency & Trust<br>• Control of Demand<br>• Confirmability of Data and Text Analysis<br>• Observation of Society in only Localized Areas |
| FRAMEWORK | | |

## Conclusion

With algorithms constructing reality in various life domains and with the gradual delegation of (moral) agency by artificial intelligence (Just and Latzer 2016), the institutionalization of algorithms as content creators evokes various ethical challenges for professional journalism.

First, the article locates these challenges in the overlapping fields of digital media ethics and cyberethics, with a special focus on journalism ethics (RQ1). Moral theories of utilitarianism, deontology, contractualism and virtue ethics are a basis to reflect the impact of Algorithmic Journalism for further research.

In addition, the article provides an ethical framework to identify and discuss these issues. The analysis was framed by Weischenberg, Malik, and Scholl´s (2006) understanding

of journalism and based on Pürer's (1992) multi-layer system of responsibility that assigns moral responsibility on an organizational, professional/individual as well as on a social sphere. A technical view of Algorithmic Journalism further helps to identify ethical challenges before, during, and after news production.

As a result of RQ2, a significant shift of responsibility in news production can be observed. With the emergence of Algorithmic Journalism, the human journalist – the individual – is not the major moral agent anymore as other actors, journalistic and non-journalistic, are involved in news production on various levels, e.g. algorithms with delegated agency, media organizations, programmer/service providers of NLG or data collectors. Thus, the importance of the individual is diminishing, whereas the importance of media organizations and the media system as moral agents is rising.

As non-journalistic actors are able to use NLG and thus have the possibility to reach an audience with a certain scope, a further challenge will be to develop and codify ethical guidelines building an ethical background for non-journalistic actors involved. This also applies to media organizations as they have to develop and adopt ethical codes of conduct for Algorithmic Journalism.

Other challenges caused by hierarchies within the media organization and the editorial department decline through the technical nature and coding of Algorithmic Journalism through external providers. Nevertheless, biases can be an ethical issue while collecting or processing data. Therefore, legal and regulatory questions arise (Darling 2012; Weeks 2015; Saurwein, Just, and Latzer 2015).

The relationship between journalists and coders during news production is an object for further research as well as it is relevant for a better understanding of power structures behind the algorithm.

The role of the audience is also to be examined but it may not be the adequate level for demanding moral responsibility as it can hardly distinguish between human and automated content if it is not labelled.

Finally, it is important to notice that Algorithmic Journalism is also able to overcome ethical challenges of the conventional media system. It may unburden the human journalist from daily routine work, may reduce economic pressure and the dictate of quantity. It frees up capacities for in-depth analysis and reporting and thus enables journalists to consider moral demands in journalistic work like checking of multiple sources, reflection, diligence, respecting human dignity, etc..

For further research, it is necessary to extend the discussion of responsibility in journalism under the influence of algorithmic processes and applications. Therefore, journalistic and non-journalistic actors on the organizational, individual/professional and social/audience level have to develop guidelines along moral and ethical values, e.g. a value sensitive design for algorithmic applications. This is the only way to meet the same ethical standards for Algorithmic Journalism as for all other professional journalistic products.

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