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Journalism and Fact-Checking Technologies: Understanding User Needs

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Fact-checking, defined as verifying information before publication, has become a prominent sub-genre of journalism over the last decade. These activities are characterized by their time-consuming aspects at each step of the process. However, it would be misleading to view this process as a sum of repetitive tasks insofar as they also depend on the nature, either textual or visual, and on the complexity of the domain related to the fact to check. Fact-checking tools are a part of the fact-checker apparatus. In this research, we provide evidence on the condition of the use of fact-checking tools, mobilizing a theoretical framework that explores the epistemology of the use and user experience concepts. This interdisciplinary approach grounded a method that relied on semi-structured interviews with fourteen professional fact-checkers and three newsroom managers from well-established news media or fact-checking organizations in Northern and Western Europe. It allowed us to identify common patterns where ethical standards of journalism and fact-checking come to the fore. The two other main requirements are a transparent and explainable process and keeping the human in the loop. Still, the use of fact-checking tools fits more into a utilitarian approach, according to which technology is not an end but a means likely to assist or augment professional practices.

Keywords: fact-checking, professional practices, digital technology, use, user experience

1. Introduction

Fact-checking relates to verifying information, which has always been a fundamental aspect of journalistic ethical norms and professional routines.[1] Still, it has become a prominent sub-genre of journalism over the last decade. It was first developed to verify political discourses and was extended to verifying content spread on social media.[2] Dedicated services were created in well-established news media, while specific fact-checking organizations have emerged to provide reliable answers to the complexity of information disorders.

Fact-checking practices consist of publishing evidence-based analyses of the validity of public claims or contents. It differs from internal procedures relating to verifying facts before publication. It would be misleading to view this process as a sum of repetitive tasks as it depends on the nature of the fact to check, either textual or audiovisual, on the sources to mobilize, and on the complexity of the application domain it relates. In this, the techniques and skills of fact-checking are also linked to investigative work that requires time to be performed.[3]

Fact-checkers are challenged by the time pressure that subtends the urgency of media coverage[4] and by information disorders that spread faster online than verified facts.[5] From this perspective, digital tools – including artificial intelligence-based solutions – can be seen as efficient support to help speed up the process and make the use of technology easier and faster.[6] Bellingcat's Online Investigation

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[1] See Mats Ekström and Oscar Westlund, "Epistemology and Journalism," in *Oxford Research Encyclopedia of Communication* (2019); and Malin Picha Edwardsson, Walid Al-Saqaf, and Gunnar Nygren, "Verification of Digital Sources in Swedish Newsrooms – A Technical Issue or a Question of Newsroom Culture?" *Journalism Practice* (2021): 1–18.

[2] See Petter Bae Brandtzaeg, Asbjørn Følstad, and María Ángeles Chaparro Domínguez, "How Journalists and Social Media Users Perceive Online Fact-Checking and Verification Services," *Journalism Practice* (2017): 1–21; and Jane B. Singer, "Border Patrol: The Rise and Role of Fact-Checkers and Their Challenge to Journalists' Normative Boundaries," *Journalism* 22, no. 8 (2021): 1929–1946.

[3] See Michelle A. Amazeen, "Journalistic Interventions: The Structural Factors Affecting the Global Emergence of Fact-Checking," *Journalism* 21, no. 1 (2020): 95–111; and Lucas Graves and Federica Cherubini, *The Rise of Fact-Checking Sites in Europe* (Oxford: Reuters Institute for the Study of Journalism, 2016).

[4] Marju Himma-Kadakas and Indrek Ojamets, "Debunking False Information: Investigating Journalists' Fact-Checking Skills," *Digital Journalism* 10, no. 5 (2022): 866–87.

[5] Soroush Vosoughi, Deb Roy, and Sinan Aral, "The Spread of True and False News Online," *Science* 359, no. 6380 (2018): 1146–51.

[6] Preslav Nakov, David Corney, Maram Hasanain, Firoj Alam, Tamer Elsayed, Alberto Barrón-Cedeño, Paolo Papotti, Shaden Shaar, and Giovanni Da San Martino, "Automated Fact-Checking for Assisting Human Fact-Checkers," in *Proceedings of the Thirtieth International Joint*

Toolkit covers more than 462 tools likely to assist and support investigative work.[7] In a state-of-the-art study of fact-checking technologies, we identified 134 tools[8] characterized by their diverse purposes. Another mapping of fact-checking technologies classified 136 tools into three categories: identification, verification, and distribution.[9]

Despite the availability of a plethora of technological tools, their practical use is not guaranteed. How these tools are employed is multifaceted and encompasses functional and social uses embedded in cultural practices.[10] Understanding these uses is further complicated by various considerations, including the context of use, the individual and social representations of the technological artifact, and the individual's prior experience with the technology. A cross-cutting approach to address the problem of uses is the fitness-for-use principle, which evaluates a product or service's ability to satisfy its users' needs.[11] Such an approach recognizes that technology is not an end but a means to an end and emphasizes the importance of understanding users' needs and preferences to ensure that technological tools are appropriately utilized.

This research, grounded in this principle, aims to understand the uses and non-uses of technological fact-checking tools, addressing three research questions: (1) Among the plethora of available technological tools, which fact-checkers are regularly used and for what purpose? (2) What are the professional requirements a technological tool should embed? (3) What are the fact-checkers' still unmet needs? The global landscape of fact-checking is highly heterogeneous, encompassing a range of actors such as journalists, researchers, open-source intelligence practitioners, and political

Conference on Artificial Intelligence (California: International Joint Conferences on Artificial Intelligence Organization, 2021).

[7] "Bellingcat's Online Investigation Toolkit," accessed May 5, 2023, https://docs.google.com/spreadsheets/d/18rtqh8EG2q1xBo2cLNyhIDuK9jrPGwYr9DI2UncoqJQ/edit#gid=930747607.

[8] "Mapping factchecking technology," accessed May 5, 2023, https://docs.google.com/spreadsheets/d/1oIFvwR8b_7v9osdJwueNo4KSBb2p7PuqOQD4XKhO7k8/edit#gid=0.

[9] See Oscar Westlund, Rebekah Larsen, Lucas Graves, Lasha Kavtaradze, and Steen Steensen, "Technologies and Fact-Checking: A Sociotechnical Mapping," in *Disinformation Studies*, edited by João Carlos Correia and Jerónimo Pedro AmaralInês (Covilhã: Labcom, Communication & Arts, 2022), 193–236.

[10] See Patrice Flichy and L. C. Libbrecht, "Connected Individualism between Digital Technology and Society," *Réseaux* 14, no. 2 (2004); Fabien Granjon, "Problematizing Social Uses of Information and Communication Technology: A Critical French Perspective," *Canadian Journal of Communication* 39, no. 1 (2014): 111–125.

[11] Ernest Mnkandla and Barry Dwolatzky, "Defining Agile Software Quality Assurance," in *2006 International Conference on Software Engineering Advances (ICSEA'06)* (IEEE, 2006).

activists.[12] Despite this heterogeneity, our study conceptualizes fact-checking as a distinct specialty within journalism and part of a broader global movement.

2. Theoretical framework

Digital tools are commonly used to support or augment journalists in their daily routines. As end-users, journalists can show antagonistic attitudes towards technological developments. Also, technological developments in journalism can be approached according to three perspectives: resilient, considering that they are unavoidable and contribute to creating specific working conditions or reinforcing professional norms;[13] reactionary, viewing technology as a threat to professional practices, values, and employment;[14] positivist, tackling technology as a lever to reinvent journalism.[15]

Such attitudes can be considered recurrent patterns throughout the history of journalism[16], testifying to the variability of the social and cultural representations associated with technological artifacts. However, technology brought new dimensions to journalism, potentially making it more democratic, transparent, or participatory, but it did not change journalism's core.[17] Research focusing on the interplay of technology with journalism also regularly emphasized a mutual shaping influenced by internal and external institutional factors.[18]

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[12] See Lucas Graves, "Boundaries Not Drawn: Mapping the Institutional Roots of the Global Fact-Checking Movement," *Journalism Studies* 19, no. 5 (2018): 613–631.; and Mena Paul, "Principles and Boundaries of Fact-Checking: Journalists' Perceptions," *Journalism Practice* 13, no. 6 (2019): 657–672.

[13] Arjen Van Dalen, "The Algorithms behind the Headlines: How Machine-Written News Redefines the Core Skills of Human Journalists," *Journalism Practice* 6, no. 5–6 (2012): 648–658; and Carl-Gustav Lindén, "Decades of Automation in the Newsroom: Why are there still so many Jobs in Journalism?;" *Digital Journalism* 5 (2017): 123–40.

[14] Neil Thurman, Konstantin Dörr, and Jessica Kunert, "When Reporters Get Hands-on with Robo-Writing: Professionals Consider Automated Journalism's Capabilities and Consequences," *Digital Journalism* 5, no. 10 (2017): 1240–1259.

[15] Joakim Karlsen and Eirik Stavelin, "Computational journalism in Norwegian newsrooms," *Journalism Practice* 8, no. 1 (2014): 34–48.

[16] Matthew Powers, "'In Forms That Are Familiar and yet-to-Be Invented': American Journalism and the Discourse of Technologically Specific Work," *The Journal of Communication Inquiry* 36, no. 1 (2012): 24–43.

[17] Barbie Zelizer, "Why Journalism Is About More Than Digital Technology," *Digital Journalism* 7, no. 3 (2019): 343–50.

[18] See Christopher W. Anderson, "Towards a Sociology of Computational and Algorithmic Journalism," *New Media & Society* 15, no. 7 (2013): 1005–1021; Pablo J. Boczkowski, "The Mutual

Outcomes from journalism studies echo user-oriented works, which state that technology is an experience that covers the cognitive process that underpins its uses and adoption, which are shaped by various social, cultural, and contextual factors.[19] Uses are also rooted in a sociological approach according to which their construction is a complex process that is both related to the functionalities provided by the technological tool, its usability, and the desire of users to interact with a technology from which they derive benefits.[20]

2.1. The multidimensionality of the concept of use

A common definition of use relates to the means to achieve or accomplish something. Although it connects to the tool, as a means, a sociological perspective approaches the problem of the uses according to the complexity of four distinct logics. These logics result from a confrontation between the tool, its function, and the user's project: 1) utilitarian logic, which consists of assessing the usefulness of an object; 2) identity logic, referring to the adequacy or inadequacy of the tool with its end-user; 3) mediatory logic, which supposes that uses depend on the intervention of a third party; and 4) evaluative logic, related to the judgment that the user makes based on its representations of the tool.[21]

Research also emphasized the overlapping of the concept of use with the notion of practice, which is considered more elaborate as it relates to the uses, behaviors, and representations.[22] In addition, research emphasized that one cannot make use of a given technology without representing it, acknowledging the critical role played by the (socio-)technical imaginary.[23] Understanding the construction of use can also be approached through the prism of the non-uses, which also covers the non-adoption (non-consumption) and the non-appropriation (lack of technical and

Shaping of Technology and Society in Videotex Newspapers: Beyond the Diffusion and Social Shaping Perspectives," The Information Society 20, no. 4 (2004): 255–267; and David Domingo, "Interactivity in the Daily Routines of Online Newsrooms: Dealing with an Uncomfortable Myth," Journal of Computer-Mediated Communication 13, no. 3 (2008): 680–704.

[19] John McCarthy and Peter Wright, *Technology as Experience* (London, England: MIT Press, 2007).

[20] See Fakhreddine Karray *et al.*, "Human-Computer Interaction: Overview on State of the Art," *International Journal on Smart Sensing and Intelligent Systems* 1, no. 1 (2008): 137–59; Robert W. Veryzer and Brigitte Borja de Mozota, "The Impact of User-Oriented Design on New Product Development: An Examination of Fundamental Relationships," *The Journal of Product Innovation Management* 22, no. 2 (2005): 128–43.

[21] Vincent Caradec, "'Personnes Âgées 'et' 'Objets Technologiques': Une Perspective En Termes de Logiques d'usage," *Revue Française de Sociologie* (2001): 117–148.

[22] Josiane Jouët, "Retour critique sur la sociologie des usages," Réseaux 18, no. 100 (2000): 487–521.

[23] Patrice Flichy, *The Internet Imaginaire* (London, England: MIT Press, 2008).

cognitive mastery of the tool). Non-uses of technology are more than just a matter of utility or popularity and cannot only be explained by an unskilled user or a poor design.[24] They can be grounded in technophobia and ideologic refusals, which are related to the apprehension of technology and the anxiety or fear it can induce. Still, the lack of perceived advantage, need, interest, motivation, or meaning could also likely lead to non-uses.[25]

The lenses of the principle of fitness-for-use, linked to the ability of a product or service to satisfy explicitly or implicitly expressed needs,[26] is another backdoor to apprehending the non-uses. Studies on the implementation of algorithmic or AI-driven tools in newsrooms show that failure often happen due to a variety of factors. These include a mismatch between the users' needs and the expected performance of the technologies, a lack of skills to effectively use the tools, a failure to integrate journalistic values into the design of the tool, and even frustration resulting from meaningless human work. At the same time, journalists generally agreed on the potential of these technologies.[27][28]

These findings resonate in the sociology of uses as choosing a technological tool requires both an adequacy with the context of use and the ability to meet the user's needs. They can also be connected to the Unified Theory of Acceptance of and Use of Technology (UTAUT), which emphasizes the performance expectancy, effort expectancy, social influence, and facilitating conditions that influence behavioral intentions to use a given technology[29]. Although expectancies are related to needs or,

[24] Madeleine Akrich, "De la sociologie des techniques à une sociologie des usages," *Techniques et culture* 16 (1990): 83–110.

[25] See Feirouz Boudokhane, "Comprendre le non-usage technique : réflexions théoriques," *Les enjeux de l'information et de la communication* 2006, no. 1 (2006): 13–22, and Neil Selwyn, "Apart from Technology: Understanding People's Non-Use of Information and Communication Technologies in Everyday Life," *Technology in Society* 25, no. 1 (2003): 99–116.

[26] Isabelle Boydens and Seth van Hooland, "Hermeneutics Applied to the Quality of Empirical Databases," *The Journal of Documentation* 67, no. 2 (2011): 279–289.

[27] See Yael de Haan, Eric van den Berg, Nele Goutier, Sanne Kruikemeier, and Sophie Lecheler, "Invisible Friend or Foe? How Journalists Use and Perceive Algorithmic-Driven Tools in Their Research Process," *Digital Journalism* 10, no. 10 (2022): 1775–1793; Gunhild Ring Olsen, "Enthusiasm and Alienation: How Implementing Automated Journalism Affects the Work Meaningfulness of Three Newsroom Groups," *Journalism Practice*, (2023): 1–17.

[28] See Laurence Dierickx, "The Social Construction of News Automation and the User Experience." *Brazilian Journalism Research* 16 np 3 (2020): 432–157.

[29] Viswanath Venkatesh, James Thong, and Xin Xu, "Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology," *MIS Quarterly: Management Information Systems* 36, no. 1 (2012): 157.

at least, professional requirements, this theory rather aligns with the broader concept of user experience.

2.2 Technology as a user experience

The concept of user experience is derived from the human-computer interaction (HCI) field. It relates to overall user satisfaction when confronted with an information system and its usability.[30] Encompassing the cognitive process at work and the emotions derived from the use, it goes beyond the concept of usability, which covers the methods for improving the ease of use during the design process.[31] Usability is also defined as the extent to which the use of a product or a service allows one to achieve specific objectives with effectiveness, efficiency, and satisfaction in a specified context of use.[32]

The *Independent International Standard Organization* (ISO) provides general guidelines for organizations to ensure the quality of their products or services. They are considered references for practitioners as they summarize good practices. Standards related to the concept of usability concern both the use of the product, the user interface and interaction, the process of developing a product, and the capability to apply user-centered design – i.e., the active involvement of users to better understand them, also in terms of tasks requirements, to favor the easiness of use.[33] Also, the user is placed at the core of several ISO standards, suggesting that a user-

[30] See Marc Hassenzahl and Noam Tractinsky, "User Experience-a Research Agenda," *Behaviour & Information Technology* 25, no. 2 (2006): 91–97; and Carine Lallemand, Guillaume Gronier, and Vincent Koenig, "User Experience: A Concept without Consensus? Exploring Practitioners' Perspectives through an International Survey," *Computers in Human Behavior* 43 (2015): 35–48.

[31] Jacob Nielsen, *Usability Engineering* (Academic Press, 1994).

[32] See Alain Abran, Adel Khelifi, Witold Suryn, and Ahmed Seffah, "Usability Meanings and Interpretations in ISO Standards," *Software Quality Journal* 11, no. 4 (2003): 325–38; and Martin Maguire, "Using Human Factors Standards to Support User Experience and Agile Design," in *Universal Access in Human-Computer Interaction. Design Methods, Tools, and Interaction Techniques for eInclusion* (Berlin, Heidelberg: Springer Berlin Heidelberg, 2013), 185–94.

[33] See Nigel Bevan, "International Standards for HCI and Usability," *International Journal of Human-Computer Studies* 55, no. 4 (2001): 533–52; Ji-Ye Mao, Karel Vredenburg, Paul W. Smith, and Tom Carey, "User-Centered Design Methods in Practice: A Survey of the State of the Art," in *Proceedings of the 2001 Conference of the Centre for Advanced Studies on Collaborative Research*; and Karel Vredenburg, Scott Isensee, and Carol Righi, *User-Centered Design: An Integrated Approach with Cdrom* (Prentice Hall PTR, 2001)..

oriented design enhances the user experience, considering the end-users, the context of uses, and the purpose of these uses.[34]

The ISO 9241-210:2010 standard, related to the ergonomics of computer systems, frames the user experience as the "perceptions and responses resulting from the use and/or anticipated use of a product, system, or service." The concept of user experience includes "all the users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviors, and accomplishments that occur before, during, and after use."[35] According to this standard, satisfaction results from using a system that meets the user's needs and expectations. Another standard, the ISO/IEC 25040-2011[36], relating to the requirements and evaluation of software products, connects the concept of quality –an inherent characteristic of the product or service– to the concept of quality of use –the extent to which the needs of a user are met under specified conditions. Hence, the needs of a given user are intrinsically related to the goals to be achieved in a given context.

Although HCI provide valuable clues to define how to meet users' expectations, it does not consider the ethical dimensions that frame end-users' practices. The growing field of ethical design aims to fill this gap, emphasizing that a user-centered design should be extended to the human values embedded in the technological object.[37] This position meets the repeated calls for better integrating AI-based systems into journalistic workflows by blending them with journalistic values.[38]

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[34] Donald A. Norman and Stephen W. Draper, eds., *User Centered System Design: New Perspectives on Human-Computer Interaction* (Hillsdale, NJ: Lawrence Erlbaum Associates, 1986).

[35] International Organization for Standardization. "ISO 9241-210:2010, Ergonomics of human-system interaction – Part 210: Human-centred design for interactive systems." Accessed May 5, 2023. https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-1:v1:en.

[36] International Organization for Standardization. "ISO 14001:2015, Environmental management systems -- Requirements with guidance for use." Accessed May 5, 2023. https://www.iso.org/standard/35765.html.

[37] Maurice Mulvenna, Jennifer Boger, and Raymond Bond, "Ethical by Design: A Manifesto," in *Proceedings of the European Conference on Cognitive Ergonomics* (2017): 51–54.

[38] See Meredith Broussard, Seth C. Lewis, Nicholas Diakopoulos, Andrea L. Guzman, Rediet Abebe, Michel Dupagne, and Ching-Hua Chuan, "Artificial Intelligence and Journalism," *Journalism & Mass Communication Quarterly* 96, no. 3 (2019): 673–95; Marisela Gutierrez Lopez *et al.*, "A Question of Design: Strategies for Embedding AI-Driven Tools into Journalistic Work Routines," *Digital Journalism* (2022): 1–20; and Tomoko Komatsu *et al.*, "AI Should Embody Our Values: Investigating Journalistic Values to Inform AI Technology Design," in *Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society* (New York, NY, USA: ACM, 2020).

3. Method

The theoretical framework grounded an interview guide composed of twenty-nine questions that aimed to understand: (1) the socio-professional context of fact-checkers; (2) the self-perception of professional values and meaning; (3) the professional routines and workflows; (4) the relationship with technology; (5) the overall user experience, in terms of use, non-use, usability, and needs. Collecting the data relied on semi-structured interviews, considering that the open-ended nature of the questions favors more depth in the answers and allows for exploring new paths, depending on the interviewee's profile.[39] From a qualitative approach, the purpose was to understand the participants' beliefs and meaning-making,[40] through a common method used both in social science and HCI.[41] Interviews were conducted in the first half of 2022, face-to-face and online when it was impossible to meet the respondent.

This research primarily targeted Four Nordic organizations devoted to fact-checking, including Faktabaari in Finland, Källkritikbyrån in Sweden, Faktisk in Norway, and Tjekdet in Denmark. These organizations are (or were) members of the International Fact-Checking Network (IFCN), which brings together professional fact-checkers worldwide and promotes excellence in fact-checking practices. They are also a part of the Nordic Observatory for Digital Media and Information Disorder (NORDIS), a consortium of researchers and fact-checkers established in four Nordic countries. They have a common size, employing between three and ten people. We conducted twelve interviews with eight fact-checkers and four newsroom managers from these organizations, i.e., about one-third of the entire staff.

To avoid essentialization, as far as "the Nordic media model" is considered a distinct cluster in Europe,[42] and to understand other forms of logic, we interviewed three professional fact-checkers in Belgium: one working at the Flemish public broadcaster VRT and in the magazine *Knack*, one at the French-speaking broadcaster RTBF, and a part-time fact-checker at the French-speaking newspaper *La Libre*

[39] See Owen Doody and Maria Noonan, "Preparing and Conducting Interviews to Collect Data," *Nurse Researcher* 20, no. 5 (2013): 28–32; and Patricia Leavy and Svend Brinkmann, "Unstructured and Semi-Structured Interviewing," in *The Oxford Handbook of Qualitative Research* (Oxford University Press, 2014).

[40] Kathryn Roulston and Myungweon Choi, "Qualitative Interviews," in *The SAGE Handbook of Qualitative Data Collection*, ed. Uwe Flick (SAGE, 2018), 233–49.

[41] Ingrid Pettersson, Florian Lachner, Anna Katherina Frison, Andreas Riener, and Andreas Butz, "A Bermuda Triangle? A Review of Method Application and Triangulation in User Experience Evaluation," in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (2018): 1–16.

[42] Trine Syvertsen, Ole Mjøs, Hallvard Moe, and Gunn Enli, *The Media Welfare State: Nordic Media in the Digital Era* (University of Michigan Press, 2014).

Belgique. The interest in Belgium relies on a country characterized by two distinct professional cultures (two journalism associations, two ethical codes of journalism, and two press councils), where fact-checking is a niche that gained interest over the past year. However, it concerns a few newsrooms and specialized organizations.[43] Knack, VRT, and RTBF participate in the *European Digital Media Observatory* (EDMO) project, to which NORDIS is affiliated. Knack and VRT are two out of three Belgian signatories of the IFCN principles. We also interviewed an R&D manager from the French press agency AFP to get an overall overview of fact-checking technology. Indeed, the *Agence France Presse* participates in the development of *InVID*, an online tool devoted to fact-checking used by fact-checkers worldwide.[44] It also has an international network of fact-checkers working in 80 countries.

The average length of an interview was 64 minutes per participant. The participants' responses were pseudonymized, except for the data about their country of origin and media organization type and size.[45] These contextual factors will likely influence their needs and practices (*Table 1*). Although our sample of interviewees presents limitations in terms of geographical scope, it is weight by the quality of the respondents, sharing the same professional interest, and by a size that fits with the requirements for phenomenological or single case qualitative studies.[46]

[43] Jonathan Hendrickx, Pauljan Truyens, Karen Donders, and Ike Picone, "Belgium (Flanders): News Diversity Put under Pressure," in *The Media for Democracy Monitor 2021: How Leading News Media Survive Digital Transformation*, ed. J. Trappel and T. Tomaz (University of Gothenburg, 2021), 7–43.

[44] Denis Teyssou, "Applying Design Thinking Methodology: The InVID Verification Plugin," in *Video Verification in the Fake News Era* (Cham: Springer International Publishing, 2019): 263–79.

[45] European Commission. "SME Definition." Accessed May 5, 2023. https://single-market-economy.ec.europa.eu/smes/sme-definition_en.

[46] See Eleanor Knott, Aliya Hamid Rao, Kate Summers, and Chana Teeger, "Interviews in the Social Sciences," *Nature Reviews Methods Primers* 2, no. 1 (2022), and Bryan Marshall, Peter Cardon, Amit Poddar, and Renee Fontenot, "Does Sample Size Matter in Qualitative Research?: A Review of Qualitative Interviews in Is Research," *Journal of Computer Information Systems* 54, no. 1 (2013): 11–22.

Table 1 – Study participants.

Code	Country	Role	Age	Context	Organization size
JFC01	Norway	Newsroom manager	40-49	Face to face	Small
JFC02	Norway	Journalist/Fact-checker	30-39	Face to face	Small
JFC03	Norway	Journalist/Fact-checker	30-39	Face to face	Small
JFC04	Norway	Journalist/Fact-checker	40-49	Face to face	Small
JFC05	Norway	Journalist/Fact-checker	30-39	Face to face	Small
JFC06	Norway	Journalist/Fact-checker	30-39	Face to face	Small
JFC07	Norway	Journalist/Fact-checker	30-39	Face to face	Small
JFC08	Sweden	Journalist/Fact-checker	40-49	Face to face	Micro
JFC09	Finland	Newsroom manager	40-49	Online	Micro
JFC10	Finland	Journalist/Fact-checker	40-49	Online	Micro
JFC11	Finland	Journalist/Fact-checker	30-39	Online	Micro
JFC12	Denmark	Newsroom manager	50-59	Face to face	Small
JFC13	Denmark	Journalist/Fact-checker	30-39	Face to face	Small
JFC14	Denmark	Journalist/Fact-checker	20-29	Face to face	Small
JFC15	Belgium (French)	Journalist/Fact-checker	30-39	Face to face	Medium
JFC16	Belgium (French)	Journalist/Fact-checker	30-39	Online	Large
JFC17	Belgium (Dutch)	Journalist/Fact-checker	30-39	Online	Large
JFC18	France	R&D Manager	40-49	Face to face	Large

All the interviews were recorded with consent, transcribed, and translated into English when it was not the language used during the meeting. These tasks were performed automatically, with a human post-edition to ensure the content's accuracy. The open-source tool *Taguette* was used to serve the purpose of qualitative data analysis (QDA), allowing to refine answers according to a set of thirty-three codes – including "skills," "practice," "ethics," "tools," "non-uses," "identity," "sources," "trust," "benefits," "limits," "automation" and "needs" – and to get a comprehensive look at the data.[47] It also allowed an inductive approach to the analysis, allowing "research findings to emerge from the frequent, dominant, or significant themes inherent in raw data."[48]

4. Findings

The following analysis consists of three complementary parts to identify the fact-checker's needs in technology, either explicitly or implicitly expressed. The first one provides the contextual elements that allow understanding the professional profile of the fact-checkers, their self-perception of fact-checking professional values, and their routines or workflows. The second part relates to fact-checkers' relationship with fact-checking technologies, including their apprehension of artificial intelligence-based solutions. The third and last part focuses on the user experience, as defined in the theoretical framework, to identify the tools regularly used by fact-checkers, their professional requirements, and the usability of the tools.

4.1. Context of use

The interviewees' professional profiles can be divided into four categories: 1) the fact-checker, whose main tasks are to monitor social media and verify content, but they can also be involved in media literacy campaigns or teaching; 2) the experienced journalist who tackles fact-checking in a "traditional" way of doing journalism and considers the phone as the most important tool; 3) the computational journalist, who handles basics of programming languages to scrape data or develop in-house projects; and 4) the newsroom manager who promotes critical skills, also towards technological

[47] See Jessica Hagman, "Centering Analysis Strategies and Open Tools for Qualitative Data Analysis," in Proceedings of the Association of College & Research Libraries Conference, ed. David M. Mueller (Association of College & Research Libraries, 2021), 394–401; and Rémi Rampin and Vicky Rampin, "Taguette: Open-Source Qualitative Data Analysis," *Journal of Open Source Software* 6, no. 68 (2021).

[48] See p. 238, Thomas, David R. "A General Inductive Approach for Analyzing Qualitative Evaluation Data." *The American Journal of Evaluation* 27 no2 (2006): 237–46.

companies although they funded operations or provided tools to detect claims to fact-check.

All the interviewees identified themselves with the social world of journalism. They connected their professional identity to journalism and fact-checking, acknowledging the specificity of the job: "*Fact-checking is part of journalism. It's [a] genre and part of investigative journalism. We use the same tools, very much the same skill sets, the same approach (...) We do not discover new things, but we revise*" (JFC01, Norway). The time-consuming nature of the job is also what is considered to make the difference with "classical" journalism activities: "*The temporality of work as we are not working a priori but a posteriori. It is what I truly consider to be the real difference*" (JFC16, Belgium).

This points to a shared representation of fact-checking, regardless of the country of origin, despite various academic paths that are not all grounded in journalism: political science, library, and information science, philosophy, history, military, and business were also mentioned. Also, we have not noticed any difference regarding the professional values of fact-checkers, which are rooted in journalism: all the interviewed fact-checkers said they followed their respective country's ethical code of journalism. According to the ethical journalism principles database developed by the Alliance of Independent Press Councils of Europe, the Norwegian, Swedish, Danish, Finnish, and Belgium codes share the core principles of accuracy, fairness, and accountability.[49]

Fact-checkers also said they followed the standards published by the *International Fact-Checking Network* (IFCN), which aim to fulfill the commitments of non-partisanship and fairness, the transparency of sources, the transparency of funding and organization, the transparency of methodology, and to an open and honest correction policy. For our interviewees, there are no significant differences between the ethical principles of journalism and the IFCN guidelines. A Danish fact-checker specified, "*The IFCN rules and the ethical press rules of Denmark more or less are the same*." Fairness, accuracy, and transparency were the most frequently used terms in the responses on the professional values of fact-checkers.

The context of the use of technological tools is also related to fact-checking routines and workflows, considering that they are likely to facilitate or augment professional practices. Here, we made no notice of differences between interviewees, they agreed that editorial processes depend on the nature of the fact to check, either textual or audiovisual. These processes – encompassing the monitoring, selecting,

[49] "Ethical Principles of Journalism: Ethical Codes Database," Alliance of Independent Press Councils of Europe, accessed May 7, 2023, https://www.presscouncils.eu/ethicalprinciples/index.php.

verifying, and writing activities – also depend on the subject. "*The fact-checking process obviously begins with the identification of a claim that you can fact-check*" (JFC04, Norway). "*The objective is to identify what reached a critical mass* [in terms of virality]. *It is, therefore, a question of fully understanding the content and being able to target and tell yourself that it is worth fact-checking. There has to be journalistic interest*" (JFC17, Belgium).

According to our panel of interviewees, their most repetitive and time-consuming tasks are monitoring social media to find claims to check (JFC02, JFC03, JFC04, JFC08, JFC11, JFC12, JFC17) – "*Finding claims. It's really boring. I just want to work*" (JFC02, Norway); "*So far as the process remains the same, my activities are repetitive. However, there is monitoring on social networks to constantly search for what is happening on a wide range of social media*" (JFC16, Belgium). Reading long reports (JFC05, Norway), searching for relevant and reliable sources (JFC02, JFC05, JFC07), verifying videos (JFC03, JFC07), and reading readers' comments (JFC08, Sweden).

Two fact-checkers also mentioned the writing – "*I think the most time-consuming is researching and writing the article*" (JFC14, Denmark); "*I love fact-checking about finding things and finding a solution, but I don't like to write. It is what I find the most repetitive about it*" (JFC17, Belgium). In addition, around half of the respondents pointed out that some information takes longer to verify than others. For example, fact-checking related to the Covid crisis was more difficult due to the scientific nature of a pandemic about which knowledge builds up over time. Finding reliable experts was acknowledged to be difficult and time-consuming.

Discourses related to the context of us placed journalism practices and values at the top. A closer look at the tasks performed by fact-checkers showed that they refer to various tools and techniques connected to investigative work, which is, by nature, time-consuming. In this process, the human is placed at the center – "*For me, it is 90% human*" (JFC02, Norway).

4.2. Representation of the technology

The four technology-oriented profiles of our panel were aware that some of their tasks could be automated to speed up the fact-checking process. However, they recognized that more than technology is needed due to the complex nature of particular topics. Hence, a combination of human expertise and technological tools is necessary. Claim monitoring, prioritization, and collecting are the main aspects that could be more automated upstream of the verification process. Nonetheless, all cannot be automated, such as finding the right source of information – "*The activities that are the most time-consuming are not that suitable for automating because it's finding the right sources*" (JFC04, Norway).

Technological pitfalls relate to human know-how and soft skills that are difficult to translate into a computer program – "*Technical limitations typically concern visual verification, which requires a lot of observation and critical thinking*" (JFC16, Belgium). Another complex human endeavor to translate into code relates to creativity, which might be needed for analyzing – "*Sometimes you have to think outside of the box*" (JFC13, Denmark); "*I also need my creativity in my head to explain*" (JFC07, Norway). Due to their undefinable nature, feelings are also complicated to tackle – "*It is impossible for a machine to interpret the human touch in the public debate because it is human, our feelings. We describe feelings, and we work within the domain between facts and feelings*" (JFC01, Norway).

Considering these limitations, digital tools are almost perceived as facilitators, and automation should be approached as an enabler rather than a complete end-to-end solution. "*Automatization could be helpful as a tool within the fact-checking process, but the fact-checking process, at least in the foreseeable future, will have to have a human touch because it is complicated since it's not mathematics*" (JFC01, Norway). In addition, we also found an emotional relationship between the fact-checker and their professional activity – "*I love my job. Don't make it too automated*" (JFC02, Norway).

Fact-checkers agreed on the helpfulness of the tools and the potential of artificial intelligence for debunking fake or manipulated content. – "*I believe automated tools are super helpful. It has to be paired with intuition and motivation about it. For detection, it would be very important*" (JFC17, Belgium). However, technology is foremost perceived for what it is: according to a Swedish fact-checker, it is only a tool. There is no magic inside it. On the other hand, fact-checkers are not always aware of using AI-based tools because they may not be informed about the technology that underlies the system they use. "*We don't always know what's behind the tool*" (JFC15, Belgium) – or just because they don't know the existence of the tool – "*I assume that there are a lot of fake news-checking tools that we don't use. But I don't know anything about them*" (JFC08, Sweden).

The need for more transparency on the technology upstream of the tool contradicts the professional values of fact-checkers, even if it does not play a decisive role in the overall representations of technical objects. However, the *Facebook* service they access as part of the Third-Party Fact-Checker Program, available to all IFCN-recognized fact-checking organizations, is a source of criticism for its black-box characteristics. First, it does not allow fact-checkers to verify political claims or advertisements. Additionally, there is a lack of information about the selection process for posts – "*A huge algorithm runs it. We don't know how [...] I don't know if they even know how it works themselves*" (JFC12, Denmark). A fact-checker also expressed the need to understand better how AI-based systems work and manage such projects –

"*Knowing what results I can expect and what results I can ask for and so on*" (JFC03, Norway).

A closer look at the reasons for not using the technology reveals a combination of the time it takes to uncover them – "*I try to keep up with the open source intelligence community [..] just to keep up to date with the tools that people develop because there are a lot of them*" (JFC03, Norway) – the time needed to try them or learn how to use them – "*I don't have time to try everything because it's very time-consuming*" (JFC16, Belgium) –; skill barriers – "*Advanced tools like using APIs, etc. are just too complicated*" (JFC12, Denmark) – and a lack of resources – "*We don't have a lot of automatic tools because of our resource problems. We didn't manage to fit in*" (JFC10, Finland). Also, technological solutions are generally perceived as allies of fact-checkers for complementing human know-how, time being the main limitation to their access.

4.3 User experience, needs, and requirements

The tools regularly used by fact-checkers can be classified into six categories: 1) social media monitoring, 2) online search, 3) verification, 4) geolocation, 5) audio transcription, and 6) automated translation (*Table 2*). The research tools developed by *Google* are generally the most used by fact-checkers and *Meta's Crowd Tangle* service – which was announced as being abandoned by *Meta* – for monitoring *Facebook*. The *InVID* plugin developed as part of the *WeVerify* and *Vera.ai* European projects is used by a third of the fact-checkers interviewed for verifying images or videos. A third of the interviewees also used open-source intelligence (OSINT) tools.

Although there are some variations in the fact-checking approaches among the interviewees, the use of *StoryBoard* by Norwegian fact-checkers highlights the significance of developing tools in a contextually appropriate manner. Indeed, *StoryBoard* is an analytics service for professionals – journalists and editors – that provides insight into the use of social media in Norwegian online newspapers.

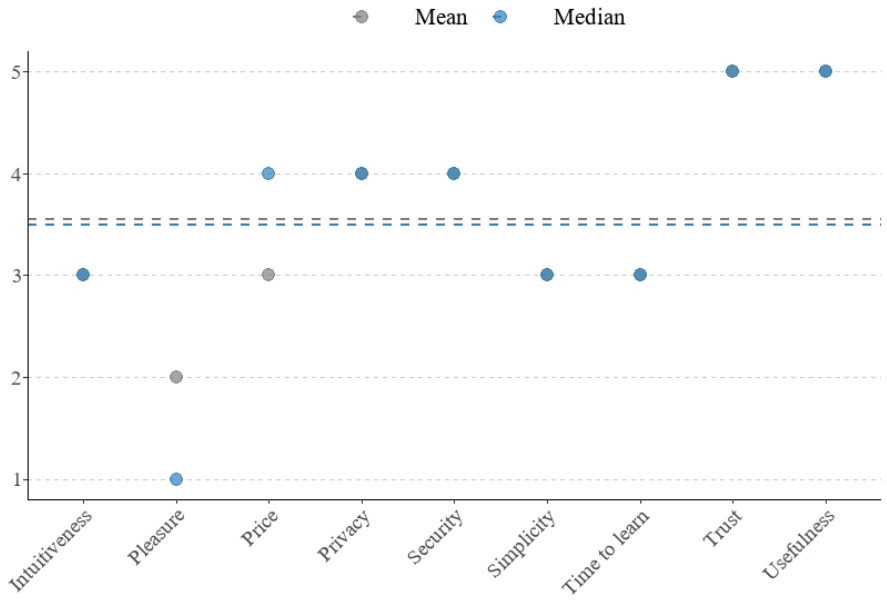
Table 2 – Reported tools used by participants.

Category	Tool	Users (%, N = 14)
Social Media Monitoring	CrowdTangle	70,6
	Storyboard.News	23,5
	TweetDeck	23,5
	Twitter Advanced Search	5,9
Online Search	Google	52,9
	WayBack Machine	41,2
	Google Cache	5,9
Verification	TinEye	41,2
	Yandex	41,2
	OSINT Tools	35,3
	InVID	29,4
	PimEyes	23,5
	Google Image	23,5
	Citizen Evidence	5,9
	Deepware	5,9
Geolocation	Google Earth	17,6
	Google Maps	11,8
	Google Street View	5,9
Audio Transcription	AmberScript	11,8
	oTranscribe	5,9
Machine Translation	Google Translate	11,8

Participants were asked to rate a digital tool's intrinsic qualities, including usefulness, intuitiveness, simplicity, privacy, security, time to learn, price, trust, and pleasure. Their responses were measured on a Likert scale ranging from 1 to 5, with 1 representing "Not important at all" and 5 representing "Very important." Fact-checkers were primarily concerned with the usefulness and trustworthiness of the tool, while the enjoyment derived from using it ranked lowest on their list of priorities (*Chart 1*). Opinions were more divided regarding the price (free or paid), the intuitiveness of the features provided, the simplicity, and the time required to learn

how to use the tool, inducing that the usefulness of the tool weighs this time-consuming aspect. "The price is an essential factor but not necessarily for fact-checkers but rather for organizations. Time is also important. When we try to automate, it is so that time-consuming tasks are reduced. Trust (…) depends on the tool. If it's on tools that will give a kind of verdict, it's still considered complicated on the forensic part. However, it's still considered complex because it depends on human interpretation" (JFC29, France).

Chart 1 – User experience evaluation.



Despite the available fact-checking tools, several needs still require to be fulfilled. Indeed, it appears since monitoring social media can be a time-consuming task, a platform that allows for simultaneous monitoring and alerts for viral claims across various social media platforms such as *Facebook*, *Twitter*, *TikTok*, or *Telegram* in a respondent's country may provide a technical rationalization for this process. This type of tool would save time that could be devoted to verification activities which are also time-consuming. Automated monitoring of political speeches also appeared as another need to be met and, this time, considering the media in which political figures regularly express themselves, including the audiovisual ones.

Assistance in detecting claims to be verified is a third track that emerges from the interviews. Finally, about verification, tools providing contextual elements, for

example, when confirming an image, is the last track that could be dug on a technical level, also considering that an image may not have been manipulated but that the context in which it appears has been manipulated. These needs were expressed during the interviews and were only sometimes explicit.

The need to consider context was implicitly highlighted when fact-checkers posed the question of language because the available tools are predominantly in English and designed for English-speaking audiences. The need for tools that provide contextual information also came several times. Two other critical factors emerged. First, the importance of adhering to the professional values of journalism and fact-checking, particularly in terms of accuracy and transparency. Second, the need to prioritize human-in-the-loop approaches since technology is insufficient and cannot fully replace the complexity of human fact-checking tasks.

5. Discussion and conclusion

Fact-checking activities cannot be reduced to a sum of repetitive tasks. As our panel of interviewees underlined, it is part of investigative work that requires time and tools to assist or augment human fact-checkers. Although socio-professional contexts vary from one checker to another, they all agreed that tools are only a part of the equation, as fact-checking requires soft human skills beyond the scope of a computer program. Developing a critical mind was the most frequently quoted skill in the answers, even when using technological tools such as a reverse image search engine, especially since images may not have been manipulated but appeared in manipulated contexts. The absence or insufficiency of contextual information from the tools regularly used for fact-checking is implicitly considered a weakness. In contrast, the need for tools that provide contextualization was explicitly expressed. From this perspective, we can consider that the relationship between fact-checkers and digital tools remains confined to a utilitarian logic of use, also considering that non-uses are mostly related to a lack of knowledge of the existence of the tools and to the time needed to master it.

Results of this research correlate with research on the skills and practices of fact-checkers, which emphasized that adopting a tool requires a combination of newsroom culture, the awareness of the tool's existence, a response to actual needs, and time for training. Research also underlined that technology is solely a means that cannot substitute fact-checkers soft skills, such as logical deduction and critical evaluation. In addition, the tools should be considered helpful in terms of accuracy, accessibility, reliability, and interpretability, which is not necessarily true for the

automated detection of, for instance, deep fakes.[50] Our research also found that paid subscriptions, user privacy, and security concerns are other brakes for fact-checking tools.

Our interviewees also generally recognized the potential for developing artificial intelligence tools to take charge of their most-consuming tasks, seeing AI as an ally rather than an adversary. The opacity of the systems is not an obstacle for use insofar as the tool fulfills its mission, such as the *Facebook* algorithm. This does not prevent criticism and highlights the need for trust when using a technical solution. The relationship between AI-based systems and their end-users is based on trust,[51] and it was confirmed in this research. Beyond this critical element, the emphasis on the professional values of journalism and fact-checking should not be overlooked. Research in journalism studies also recognized this need. However, how to practically meet this need?

In order to satisfy the insistence on the inherent human nature of fact-checking, a human-in-the-loop approach – whether in design or in terms of usability – could potentially provide the solution. It can also be viewed as an efficient way to overpass the limitations of the current fact-checking systems insofar as they still need human supervision due to the inherent complexity of estimating the reliability and trustworthiness of a given information.[52] Another answer is making the systems more transparent or, at least, more explainable by providing information on how the system operates and on which data it relies. Such approach would also enhance the needed AI literacy in journalism.[53]

The use of AI-based tools seen as complementary techniques to gain time and accuracy participates in a growing shift towards automation in the newsrooms, which can be seen either as a lever for augmenting journalism or as a market-driven tool that

[50] Teresa Weikmann and Sophie Lecheler, "Cutting through the Hype: Understanding the Implications of Deepfakes for the Fact-Checking Actor-Network," *Digital Journalism*, (2023): 1–18.

[51] Keng Siau and Weiyu Wang, "Building Trust in Artificial Intelligence, Machine Learning, and Robotics," *Cutter Business Technology Journal* 31 (2018): 47–53.

[52] See Gianluca Demartini, Stefano Mizzaro, and Damiano Spina, "Human-in-the-Loop Artificial Intelligence for Fighting Online Misinformation: Challenges and Opportunities," *IEEE Data Engineering Bulletin* 43, no. 3 (2020): 65–74; and David La Barbera, Kevin Roitero, and Stefano Mizzaro, "A Hybrid Human-in-the-Loop Framework for Fact Checking," in *Proceedings of the Sixth Workshop on Natural Language for Artificial Intelligence* (2022).

[53] Mark Deuze and Charlie Beckett, "Imagination, Algorithms and News: Developing AI Literacy for Journalism," *Digital Journalism* 10, no. 10 (2022): 1913–18.

affects work organizations within newsrooms.[54] For our panel of interviewees, AI and automation are seen as having great potential, but only as a means among others. From a technological perspective, fact-checking technologies still need to be improved. This is partially due to the lack of consideration of fact-checkers as end-users and the difficulty of translating into computational code complex concepts such as "claim" and "verification", that involve critical thinking.[55] This is all the more challenging since large language models generate content that does not correspond to real-world input without having been asked for. Detecting these so-called "artificial hallucinations" has also become one of the biggest challenges to tackle, as it also triggers a broader reflection about what makes the factuality of an event.[56] However, our research was conducted before the breakthrough of generative AI. With the rapid spread of tools for disinformation at scale, it might be that a new user study would reveal a wholly new level of fact-checking challenges in an AI-driven landscape.

[54] See Carl-Gustav Lindén, "Decades of Automation in the Newsroom: Why are there still so many Jobs in Journalism?;" *Digital Journalism* 5 (2017): 123–40.

[55] See Laurence Dierickx, Carl-Gustav Lindén and Andreas L. Opdahl, "Automated Fact-Checking to Support Professional Practices: Systematic Literature Review and Meta-Analysis", *International Journal of Communication* 17 (2023): 5170–5190.

[56] See Laurence Dierickx, Carl-Gustav Lindén and Andreas L. Opdahl, "The Information Disorder Level (IDL) Index: A Human-Based Metric to Assess the Factuality of Machine-Generated Content," in *Disinformation in Open Online Media, MISDOOM 2023*, ed. Davide Ceolin, Tommaso Caselli and Marina Tulin, *Lecture Notes in Computer Science*, 14397 (2023), 62.

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