

© Copyright 2024

Aparna Ghosh

Pushing Journalism Boundaries: Understanding The Evolving Identities, Roles,
And Professional Challenges Of Interactive Journalists

Aparna Ghosh

A dissertation

submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

University of Washington

2024

Reading Committee:

Adrienne Russell, Chair

Ricardo Gomez

Benjamin Mako Hill

Chirag Shah

Program Authorized to Offer Degree:

Communication

Abstract

Pushing Journalism Boundaries: Understanding The Evolving Identities, Roles, And Professional Challenges Of Interactive Journalists

Aparna Ghosh

Chair of the Supervisory Committee:

Adrienne Russell

Communication

This dissertation seeks to understand the under-explored experiences and perspectives of the professionals driving interactive journalism. It bridges that gap by delving into the evolving identities, roles, and professional challenges faced by interactive journalists who stand at the forefront of this technically-laden format of visual storytelling. Through in-depth interviews with 24 interactive journalists and content analysis of 24 participants and 18 additional (total = 42) data journalism award winners' LinkedIn profiles, this research paints a vivid and nuanced portrait of the pioneers pushing the boundaries of journalistic innovation. The findings underscore the multidisciplinary nature of interactive journalism, highlighting the array of skills and perspectives required to create compelling interactive stories that resonate with modern audiences. The study also sheds light on the potential tensions such as inconsistent byline

(attribution) policies and being treated like a "service desk" and power dynamics that can arise as these diverse actors seek to establish their place and assert their value within traditionally structured newsrooms. With rapid advancements in technology, and many finding its way into newsrooms, this dissertation argues that the experiences of interactive journalists offer a crucial window into the future of journalism in the digital age. It concludes with a taxonomy categorizing the different types of interactive journalists based on the different aspects analyzed in the study, providing valuable insights for scholars, educators, and news organizations. By examining the challenges and opportunities interactive journalists face, this research contributes to a more nuanced understanding of who really is in the contemporary newsroom today, what the evolving nature of journalistic practice is, and how we can help foster a more inclusive, equitable, and collaborative newsroom ecosystem.

For my Baba, Aarav and Casey. Thank you for everything.

Special thanks to Dr. Adrienne Russell, my advisor, who not only mentored and guided me throughout this journey but also edited this dissertation for months, even though she was on sabbatical; my editor, Dr. Kathryn Burrows, who patiently brainstormed all my crazy ideas with me; my methods advisor, Dr. Ricardo Gomez, who, simply put, taught me everything I know about research; Dr. Mako Hill, Dr. Chirag Shah, and Dr. Matthew Powers for being there unconditionally to support and champion me, no matter what.

No words can thank you enough.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION.....	9
Dissertation Questions and Purpose.....	22
Methods.....	26
Sampling.....	27
Data Collection.....	32
Data Analysis.....	35
Structure of the Dissertation.....	39
CHAPTER 2: WHO IS AN INTERACTIVE JOURNALIST?.....	40
I. Introduction.....	40
II. Literature Review.....	42
III. Findings.....	48
Interactive Journalists Have Varied Backgrounds.....	48
Journalism Background.....	49
Computer Science Background.....	49
Design Background.....	50
Other Backgrounds.....	51
Interactive Journalists Forge Paths Through Education and Hands-On Experience.....	51
Intrinsic Motivations: Passion Fuels Interactive Journalists' Pursuits.....	57
Sparkling the Flame: Influential People, Projects, and Personal Experiences.....	57
Pioneers of Progress: Advancing Data Journalism in Emerging Markets.....	58
The "Journalism Bug" - Intrinsic Motivation and Early Influences.....	59
Coding Meets Storytelling: Blending Technical Skills and Journalistic Pursuits.....	60
A Distinct External Motivator - Interactive Journalism as a Path to Immigration.....	62
Career Trajectories: Interactive Journalists Navigate Diverse Paths.....	63
Early practitioners (0-4 years experience before IJ).....	65
Mid-career pivoters (5-9 years experience before IJ).....	66
Late-career pivoters (10+ years experience before IJ).....	67
The Prevalence of Teaching Among Interactive Journalists.....	68
Exiting Interactive Journalism: Navigating Burnout and Career Transitions.....	70
III. Discussion and Conclusion:.....	74
CHAPTER 3: WHAT DO INTERACTIVE JOURNALISTS DO? REDEFINING PRACTICES AND WORKFLOWS FOR A NEW ERA OF JOURNALISM.....	76
Introduction.....	76
Literature Review.....	80

Findings.....	85
Newsroom Functions.....	85
Core Journalistic Functions.....	86
1. Pitching Data-Driven Stories.....	86
2. Crafting Interactive Narratives.....	88
3. Editing for Accuracy and Visualization.....	92
Specialized Work.....	94
4. Acquiring and Interrogating Datasets.....	94
5. Translating Data into Interactive Visuals.....	96
Discussion And Conclusion.....	100
CHAPTER 4 - NEWSROOM INTEGRATION CHALLENGES AND HOW INTERACTIVE JOURNALISTS NAVIGATE THEM.....	105
Introduction.....	105
Literature Review.....	109
Findings - Challenges in the Interactive Journalism Newsroom.....	115
Data and Interactive Teams Treated as 'Service Desks'.....	115
Everyday Professional Blindspots: “They Just Don’t Get It!”.....	126
Discussion and Conclusion.....	135
CHAPTER 5: CONCLUSION.....	143
Review of Findings.....	144
Who is an interactive journalist?.....	144
What does an interactive journalist do?.....	146
What challenges do interactive journalists face in newsrooms?.....	147
A Reflective Taxonomy - The Kinds Of Interactive Journalists.....	148
The Mutants.....	150
Vignette: Christopher Udemans.....	150
What are their characteristics?.....	151
The Catalysts.....	154
Vignette: Sondre Solstad.....	154
What are their characteristics?.....	156
The Hybrids.....	159
Vignette: Rahul Mukherjee.....	159
What are their characteristics?.....	161
What this does for our understanding and why it matters.....	163
The Taxonomy and Career Trajectories.....	163
Limitations and Future Research.....	165
Reflecting on Why Understanding Interactive Journalists is Important and Relevant	

Today.....	167
APPENDICES.....	172
APPENDIX A.....	172
APPENDIX B.....	175
BIBLIOGRAPHY.....	176

CHAPTER 1: INTRODUCTION

Thirteen years ago, Matthew Conlen graduated from the University of Michigan with a double major in computer science and applied mathematics. In 2022, he got his doctorate in computer science at the University of Washington, where he studied the intersection of human-computer interaction and data visualizations. Conlen, an interactive journalist who identifies more as a journalist than a technologist or "computer scientist," was part of *The New York Times* (NYT) staff that won the 2021 Pulitzer Prize for Public Service for its coverage of the COVID-19 pandemic. Conlen is an example of an interactive journalist, who I define here for this dissertation as, *“a professional who combines their commitment for journalism with their expertise in programming, data analysis, and design to craft innovative, impactful, and memorable stories that shape public discourse.”*

The rise of interactive journalism is part of a broader trend towards the diversification of journalism in the digital age. Journalism as an industry is confronting an unprecedented convergence of challenges that threaten its very foundation. The once-robust business model that sustained the industry for decades has been undermined by a perfect storm of technological disruption, evolving consumer preferences, and shifting advertiser priorities. At the heart of this transformation lies the inexorable rise of digitization, which has fundamentally altered the way news is produced, distributed, and consumed. Newspapers are grappling with the urgent need to diversify their revenue streams and adapt to a new media landscape where traditional print advertising and circulation no longer suffice. However, diversification alone is insufficient to address the multifaceted nature of the crisis. The industry must also contend with a host of other pressing concerns, such as the erosion of public trust, the proliferation of fake news, and the

increasing fragmentation of the media landscape. As newspapers navigate this uncharted territory, they must confront the stark reality that the old ways of doing business are no longer viable and that a radical reimagining of their role and purpose is necessary for survival. This diversification is transforming the fourth estate by infusing it with fresh perspectives, diverse talent, and cutting-edge skill sets, such as big data development and management (Ruotsalainen, 2018). The changing face of journalism features innovative formats like data visualizations, interactive features, and gamified content. This demands that journalists have a new skill set and different backgrounds than previous generations ("Audience Teams Diversify Their Approach," n.d.).

Conlen has been a part of the computation and journalism community since 2012 when he got his first journalism-related job at HuffPost Labs as a developer. Fast-forward 13 years later, he is now a graphics editor at *The New York Times*. In the time that he has been an interactive journalist, Conlen has done all of these things, and more. He led the 2016 election interactive predictions for FiveThirtyEight and created detailed county constituency maps for the 2020 election results for *The New York Times*, while also building interactive features for The Times using global COVID data and predictions to help the world comprehend the pandemic and its varying impacts around the globe. Conlen's innovative approach to journalism, which emphasizes graphic and visual storytelling through code, represents a departure from traditional reporting methods. While his work has garnered prestigious international recognition, it also highlights the challenges that arise when different professional norms, values, and expectations coexist within a news organization. Conlen must navigate a complex landscape where his practices and values as a journalist may not always align with those of his colleagues. This disparity can lead to tensions and misunderstandings as the organization adapts to accommodate

new forms of journalism alongside established ones. As a result, Conlen faces the unique challenge of advocating for his approach while also finding ways to bridge the gap between his work and the expectations of others in the newsroom. His experience underscores the ongoing evolution of journalism and the importance of fostering a culture that embraces diverse perspectives and methods in the pursuit of excellence.

Interactive journalism can be seen as part of a broader trend towards data visualization and computational journalism in the news industry. As Cairo (2012) and Weber & Rall (2012) have documented, journalists have long used visual representations to convey complex information, but the digital age has brought new tools and techniques for creating interactive and data-driven stories. Interactive journalists, with their diverse backgrounds and expertise, are at the forefront of this shift. This means that there is a change in educational backgrounds and skill sets of journalists in the digital age, as noted by Opgenhaffen & d'Haenens (2015) and Spyridou & Veglis (2016).

Journalists across the globe are grappling with the need to utilize data in innovative ways for their reporting. Two prevalent forms of data usage in journalism are commonly known as "data journalism" and "interactive journalism." Data journalism involves unearthing stories from data and presenting them in the most suitable format for public consumption and reuse (Heravi, 2017). Visualization scholars look at data journalism as a form of reporting based on collecting, visualizing, and narrating data (Morini, 2024). Interactive journalism, on the other hand, is a visual storytelling approach that employs code to enable users to engage with the reported information (Usher, 2016). She defines interactive journalism as “a visual presentation of storytelling through code for multilayered, tactile user control for the purpose of news and information.” Its practitioners are called interactive journalists, who have varying backgrounds

and skills. The key difference between data journalism and interactive journalism, and practitioners of these specific forms of information journalism, is that interactive journalism is more participatory, deliberate, expertise-driven and interaction focused than other forms of journalism. Data journalism, on the other hand, is more prevalent and even commonplace with the kind of technological advancement in the media industry (Usher, 2016). Because data journalism just entails the usage of data (numbers, statistics etc.) or applications such as Microsoft Excel, Google Sheets etc., it is difficult for today's journalists to say that they are completely insulated from some form of data journalism. This is especially true because data journalism is an expected progression (or evolution) of traditional journalism and is grounded in values associated with traditional journalism (Coddington, 2020). Interactive journalism requires more technical expertise and coding background, and is grounded in the values inherent in the fields of technology and computer science (Usher, 2016; Coddington, 2020). This dissertation focuses on interactive journalists because they embody the convergence of diverse skill sets, professional backgrounds, and cultural perspectives that are reshaping the modern newsroom. As pioneers in an emerging field, interactive journalists represent a significant departure from traditional journalism practices, introducing novel approaches to storytelling that transcend the use of numbers and statistics alone. By harnessing the power of coding, data visualization, and multimedia elements, interactive journalists challenge conventional notions of what journalism can be and how it can engage audiences. Their work not only pushes the boundaries of the profession but also highlights the tensions and opportunities that arise when disparate journalistic cultures and norms collide within news organizations. As such, studying interactive journalists provides a unique lens through which to examine the transformative forces that are redefining the role and purpose of journalism in the digital age.

While interactive journalists share some commonalities with data journalists, they also have distinct professional identities and role perceptions. Studies by Appelgren & Nygren (2014) and Parasie & Dagiral (2013) have explored how these technologically-savvy journalists navigate the boundaries between journalism and programming, often seeing themselves as bridging two worlds. Understanding these unique identities is crucial for examining the place of interactive journalists within the newsroom. As pioneers in an emerging subfield, interactive journalists undergo a process of professional socialization to become competent members of a community of practice (Wenger, 1999; Gravengaard & Rimestad, 2012; Wahl-Jorgensen, 2017).

Interactive journalists perceive journalism, journalism careers, and newsroom practices and culture differently than traditional journalists (Usher, 2016). The diverse professional backgrounds and divergent perceptions of journalism's nature and purpose held by traditional journalists and interactive journalists can lead to clashes within newsrooms. These conflicts often center around the role and practice of data visualization in journalism. Traditional journalists, rooted in conventional reporting methods, may view data visualization as a supplementary tool to enhance storytelling. In contrast, interactive journalists, with their skills in coding and design, see data visualization as an integral part of the journalistic process, capable of revealing insights and engaging audiences in new ways. These differing perspectives can spark debates about the validity, ethics, and effectiveness of data visualization practices, as well as their place within the larger framework of journalism. Resolving these conflicts requires a deeper understanding of the underlying assumptions and values that shape each group's approach to journalism, as well as a willingness to find common ground and embrace the evolving nature of the profession in the digital era. Therefore, the integration of technologists, in this case interactive journalists, into newsrooms is not always a smooth process. Research by Ananny & Crawford (2015) and

Kosterich & Weber (2019) has highlighted the organizational tensions and cultural clashes that can arise when journalists and technologists collaborate. Interactive journalists, as pioneers straddling these two fields, may face particular challenges in negotiating their roles and advocating for their work. These challenges can be understood through the lens of "boundary work" (Carlson & Lewis, 2015; Hermida & Young, 2019), as interactive journalists navigate the shifting terrain of the journalistic field and seek to establish their place within the profession. An instance of this clash in perspectives occurred when an editor asked Conlen to remove all labels and legends from a data visualization, arguing that their presence would "distract readers" from the narrative. This request highlights the disconnect between traditional journalistic priorities, which often emphasize the primacy of the written story, and the approach of interactive journalists like Conlen, who view data visualizations as integral to the storytelling process. For interactive journalists, labels and legends are essential elements that provide context, clarity, and accessibility to the data being presented. Removing these components could undermine the effectiveness of the visualization and limit its ability to convey meaningful insights to the audience. This example underscores the ongoing tension between traditional and interactive journalism practices, as well as the need for newsrooms to foster a culture of collaboration and mutual understanding to effectively integrate these diverse approaches to storytelling. Conlen said,

We were not on the same page. From his (the editor's) perspective, the data visualization seemed like just an aesthetic image that should be clutter-free. They did not quite comprehend that it was a crucial part of the story. Anyone who knows any sort of data visualization best practices would know that.

What it came down to is that Conlen, the visualization expert, had a different perspective about the role of visualizations in journalism than the editor, who understood visualizations as a way to help "the reader in some way." Conlen managed to convince the editor to do it his way in the end, and the infographic was printed with all its core elements. That was not the only time Conlen had to defend his work, and many interactive journalists struggled with negotiating the different perspectives of what journalism should be between traditional journalists and interactive specialists. This example underscores the ongoing tension between traditional and interactive journalism practices, which Chapter 3 will explore in more depth.

Various technical skills, organizational roles, and personal values shape interactive journalists' work (Article Computational Journalism.Pdf, n.d.; Fink & Anderson, 2015). When perspectives between interactive journalists and traditional journalists clash, the processes they follow as a team are modified (Lewis & Usher, 2014). This patchwork of the values and norms of both groups, where journalistic knowledge and programming prowess meet, has been called a "trading zone" by journalism scholars. Interactive journalism trading zones are informal and fleeting spaces in which interactive journalism projects are constructed (Usher, 2018). There exists abundant scholarship about the rapidly changing sociological norms and values of journalistic practice (Moreira & Oller Alonso, 2018). However, with few exceptions, there is little discussion about the emergent norms of interactive journalism (Tandoc & Oh, 2017). Chapter 4 will examine in detail the tensions and challenges interactive journalists like Conlen face when integrating their innovative approaches into traditional newsroom structures.

Conlen's experiences as an interactive journalist in the newsroom illustrates the struggle between "old" and "new" journalism. Especially in the context of big data journalism production (Wu et al., 2019), of which interactive journalism is a subtype, there is not much literature about

the backgrounds and struggles of these journalists, let alone the impact they have on everyday journalism. In this dissertation, I aim to address the gap in the literature by exploring the experiences, backgrounds, and challenges faced by interactive journalists like Conlen in the contemporary newsroom. By focusing on the struggle between "old" and "new" journalism practices, particularly in the context of big data journalism production, I seek to shed light on the complex dynamics that shape the work of interactive journalists and their impact on the evolving landscape of journalism.

This research examines interactive journalists' evolving roles, identities, and professional challenges in an era predating the widespread adoption of generative AI technologies, such as ChatGPT, in newsrooms. While the implications of AI on journalism are still unfolding, with ongoing debates surrounding ethics, efficiency, education, and expertise (Pavlik, 2023; Arguedas & Simon, 2023; Hudíková, 2023; Fang et al, 2024; Jones et al, 2023) this study focuses on interactive and data journalism that relies on human journalists as central and indispensable parts of the process. It captures and investigates a pivotal moment when skilled professionals reshaped storytelling by integrating data, interactive visualizations, and coding into their work.

The experiences and challenges of interactive journalists highlighted in this research provide valuable lessons for understanding future technological developments in journalism. By examining how these professionals have navigated the incorporation of new tools and practices into their work, this study emphasizes the importance of fostering a culture of continuous learning, collaboration, and experimentation within newsrooms. This adaptability will be crucial as journalism continues to evolve alongside emerging technologies like AI. Furthermore, the findings underscore the need for journalists to develop a deep understanding of the technologies

they work with, enabling them to critically assess their implications and communicate their potential benefits and risks to the public.

As AI and other emerging technologies become more prevalent in society, journalism will play a vital role in fostering public trust and understanding. This research on interactive journalists can highlight the importance of maintaining human oversight and judgment in the application of these technologies within journalism. By demonstrating the value of human expertise, creativity, and critical thinking in the interactive journalism process, this study argues for the continued centrality of human journalists in an AI-driven future. Moreover, the findings can emphasize the potential for journalists to serve as watchdogs and educators, investigating and explaining the implications of new technologies to the public. By providing accurate, unbiased, and accessible information about AI and other emerging tools, journalists can help mitigate the spread of misinformation and promote a more informed public discourse.

While this entire practice of interactive journalism may change in the future, considering AI tools have abilities to both code and write, it reminds us that journalism has stood the test of time alongside many technological disruptions, such as the rise of radio, television, and the internet, and continues to withstand incorporating new innovations. By highlighting journalism's successful navigation of past disruptions, this research argues for its continued ability to evolve and remain relevant in an AI-driven future. Additionally, it emphasizes the enduring value of journalistic principles such as accuracy, transparency, and accountability, which will become even more crucial as the media landscape grows increasingly complex. This research offers a window into the resilience and adaptability of the journalistic profession as it navigates the challenges and opportunities presented by emerging technologies. By situating the experiences of interactive journalists within the broader context of journalism's relationship with technology,

this study contributes to the ongoing conversation about how the profession can adapt to and shape the development of emerging technologies in the years to come.

In this dissertation, I will delve into the unique skill sets, professional backgrounds, and cultural perspectives that interactive journalists bring to the table. By investigating the conflicts and tensions that arise when these diverse approaches to journalism intersect with traditional practices, I aim to discuss the underlying assumptions, values, and priorities that drive these clashes. By analyzing the practices, ethics, and effectiveness of data visualization and other interactive storytelling techniques, I seek to contribute to the limited body of knowledge surrounding the struggles and triumphs of interactive journalists in the modern newsroom.

Ultimately, this research aims to provide a nuanced understanding of the impact that interactive journalists like Conlen have on everyday journalism. By illuminating the challenges they face and the innovative approaches they bring to the profession, this dissertation seeks to foster a more inclusive and collaborative newsroom culture that embraces the diverse skills and perspectives necessary for journalism to thrive in the digital age.

In the current scholarly literature, interactive journalism is often subsumed under the broader category of data journalism. Data journalism, which involves the use of data and computational techniques to uncover and tell stories (Coddington, 2015; Hermida & Young, 2019), has been a major focus of research on journalistic innovation in recent years. This literature has explored the practices, skills, and identities of data journalists (Appelgren & Nygren, 2014; Parasie & Dagiral, 2013), as well as the organizational challenges of integrating data teams into newsrooms (Borges-Rey, 2016; Weber & Kosterich, 2018). While interactive journalism, with its focus on creating data visualizations and interactive features, represents a distinct subfield with its own unique challenges and considerations, it is often included under the

umbrella of data journalism in scholarly discussions. So, what do we know about these new age data journalists?

The State of Data Journalism 2021 report, which surveyed 1595 data journalists across the globe, found that more than 70 percent of these specialized journalists had degrees in the arts (52%) or social sciences (20%). In contrast, fewer than 20 percent had technical degrees in the computer sciences, mathematics, or statistics. The report also pointed out that data journalists feel much more like "journalists" than "data analysts" and felt pressured to create better visuals. While data journalists reported learning from other specialty or traditional journalists, they identified differing levels of technology expertise and newsroom culture as the most significant challenges they faced.

Hepp and Loosen (2021) describe the group of professional change agents as pioneer communities, i.e., a "particular group of professionals who incorporate new organizational forms and experimental practice in pursuit of redefining the field and its structural foundations." Pioneers regard themselves as an organizational elite who embody imaginations of the future of journalism and aim at transforming journalism on a structural level (Hepp and Loosen, 2021). These pioneers, who include data and interactive journalists, are redefining journalism, shaping the future of the field.

Extant literature focuses on the success of traditional journalists and programmers working together in the newsroom (Lewis & Usher, 2015; Usher, 2016). In this dissertation, I explore how the career paths and motivations of interactive journalists shape their roles and challenges in the newsroom. According to Stringer (2016), when conflicting values are negotiated, attached, and reattached, new "rules of the game" are produced, changing the purpose and practice of the activity. Focusing on what is considered "appropriate" and what is "deviant"

highlights how these technicians influence the changing definitions of journalism (Carlson & Lewis, 2015). Inviting programmers and data scientists and their skills, norms, and values into journalism has transformed the newsroom in ways that the creators of the first ever infographic many decades ago could never have imagined.

Bourdieu's conceptualization of fields is useful for analyzing the experiences of interactive journalists navigating the boundaries and norms of journalism. Field Theory in journalism is a theoretical construct that accounts for the social space "between the individual news organization and the society as a whole" (Benson, 2006). In Bourdieu's conception, the social world is a system of 'fields' engaged in a constant struggle between two major forces: the power arising from economic capital and the strength created from cultural capital (Bourdieu, 1993). The aim of Field Theory is to understand the journalism field by examining the people within it and how they relate to other concepts, ideas, and people in other fields (Benson, 2006). By examining their entry points, motivations, roles, and challenges, this research sheds light on the ongoing negotiation of journalism's values, practices, and professional identities in the face of technological and societal change. A journalist's position in the field dictates how they react to economic hardships and technological changes (Powers & Vera-Zambrano, 2019).

As interactive journalism emerges within the journalistic field, new dynamics surrounding norms and boundaries come into play. The integration of new practices and professionals into the field has led to tensions and negotiations surrounding journalistic norms and boundaries (Anderson, 2013; Vos & Craft, 2017). This phenomenon can be understood through the lens of Pierre Bourdieu's concept of Field Theory, which examines the social spaces where different forms of capital – economic, cultural, and symbolic – are negotiated and contested (Benson, 2006; Danzon-Chambaud & Cornia, 2023).

As newcomers to the journalistic field, interactive journalists undergo a process of professional socialization, engaging in what Carlson and Lewis (2015) and Hermida and Young (2019) term "boundary work" – the negotiation of boundaries and norms that define what counts as journalism and who counts as a journalist. This boundary work takes place within the context of shifting journalistic "doxa" – deeply internalized understandings of how journalism ought to be practiced (Bourdieu, 1993).

The concept of "cultural capital" (Bourdieu, 1986), which encompasses educational credentials, technical expertise, and artistic sensibilities, is particularly relevant in understanding the unique position of interactive journalists. As they bring diverse skill sets and backgrounds to the newsroom, they challenge traditional notions of the cultural capital required for journalistic practice, potentially disrupting established doxa.

This dissertation aims to contribute to the growing body of research on journalistic innovation and the changing boundaries of the profession in the digital age. By focusing on the experiences and challenges of interactive journalists, it builds on previous studies of data visualization in journalism (Cairo, 2012; Weber & Rall, 2012), the professional identities of computational journalists (Appelgren & Nygren, 2014; Parasie & Dagiral, 2013), the integration of technologists into newsrooms (Ananny & Crawford, 2015; Weber & Kosterich, 2018), and the impact of data-driven journalism on audience engagement (Borges-Rey, 2016; Young, Hermida, & Fulda, 2018). At the same time, it extends this research by providing a more focused and in-depth examination of the specific subfield of interactive journalism, and by employing a multi-method approach to investigate the entry points, motivations, roles, and challenges of interactive journalists. Chapter 2 will dive deeper into unpacking the diverse backgrounds,

motivations and entry points that lead professionals like those discussed here to pursue careers in interactive journalism.

Dissertation Questions and Purpose

This dissertation examines precisely who the interactive journalist is: what normative pressures they bring to the newsroom, and how they ended up in the newsroom in the first place. I see a reflection of my own identity and journey in this definition. I am an interactive journalist, with an undergraduate degree in computer science engineering and a master's in magazine journalism, and at every stage of my life, people have asked me "Why?" (For a more detailed account of my personal journey, please refer to Appendix A). This dissertation represents the culmination of my quest to find more answers to those 'whys' and the paths other interactive journalists took to get where they are. It explores how interactive journalists' entry into journalism shapes their roles and challenges in the newsroom. It bridges these gaps in the literature by examining the norms, values, and tensions associated with the production of interactive journalism. Having experienced some of the challenges and rewards of navigating this intersection of two worlds makes me well-positioned to tell the stories of other interactive journalists.

This global qualitative project utilized qualitative methods (interviews and content analysis) in order to triangulate and strengthen the data. Only English-speaking journalists were included in the project. There are two methods used in this project: 24 in-depth semi-structured interviews with interactive journalists and content analysis of the same interactive journalists' LinkedIn profiles. Combining the research methods in this way illustrated the motivations for entering professional interactive journalism and how those motivations and values shape their roles and challenges. A benefit of this two-pronged approach to qualitative research was that I

could compare, contrast, and corroborate the findings from these different forms of data collection, which made the findings more robust.

The project investigates the following overarching question: **How do interactive journalists' backgrounds and entry into journalism shape the roles they play and challenges they face in the newsroom?**

This larger question led to the following two sub-questions:

RQ1: What are the points of entry and motivations that lead people to pursue the path of interactive journalism?

RQ2: How do interactive journalists negotiate their careers, roles, and challenges in the newsroom?

Understanding what motivates someone to become an interactive journalist and how they navigate their roles and challenges in the newsroom sheds light on the changing nature of journalism itself. As digital technologies continue to reshape the media landscape, interactive journalism represents a cutting edge of innovation that is pushing the boundaries of what journalism can be. By examining the pioneers leading this charge, we gain insight into how journalism is evolving and what the future may hold for the profession.

This dissertation aims to contribute to the broader discourse on the transformative shifts occurring within journalism. As interactive journalists challenge traditional norms and practices, they are not only redefining their own roles but also reshaping the very essence of what it means to be a journalist in the digital age. By exploring the experiences and perspectives of these trailblazers, we can better understand the potential trajectories of journalism's evolution.

The future of the profession, in this context, refers to the ways in which journalism will continue to adapt and innovate in response to the ever-changing technological, social, and

economic forces that shape the media landscape. As interactive journalism gains prominence and influences the wider journalistic community, it is likely to play a significant role in charting the course for the profession's development. By investigating the challenges, opportunities, and implications of this emerging field, this dissertation seeks to provide valuable insights into the skills, mindsets, and approaches that will define the next generation of journalists and the future of journalism itself

This dissertation builds on and extends previous research on journalistic innovation, professional identity, and field dynamics by focusing specifically on the experiences and challenges of interactive journalists. While studies have examined the integration of technologists into newsrooms (Ananny & Crawford, 2015; Weber & Kosterich, 2018) and the professional identities of data and computational journalists (Appelgren & Nygren, 2014; Parasie & Dagiral, 2013), there has been less attention paid to the unique position of interactive journalists as pioneers in an emerging subfield. By investigating their entry points, motivations, roles, and challenges, this study aims to shed light on how interactive journalism is reshaping the boundaries and norms of the journalistic field.

Interactive journalism does not exist in a vacuum. It emerges within a field that has long-established norms, values, and power structures. As interactive journalists enter newsrooms, they must negotiate their place within this existing order. This can lead to creative tensions as different conceptions of journalism collide, but it can also spur the development of new hybrid forms of journalism that blend the old and the new.

The entry paths and motivations of interactive journalists themselves can tell us much about the priorities and values being imported into newsrooms. Nikki Usher (2016) argued that different interactive journalists, based on what field they come from, bring different skill sets,

assumptions, and objectives to their work. Discussing what drives these pioneers helps explain the direction interactive journalism is headed and the mark it is leaving on journalism as a whole.

In this dissertation, I argue that the experiences of interactive journalists offer a unique window into the ongoing negotiation of journalism's values, practices, and professional identities in the face of rapid technological and societal change. This perspective is crucial because it illuminates the complex and often contentious process by which journalism evolves and adapts to new realities.

As digital technologies continue to disrupt traditional models of news production and consumption, interactive journalists find themselves at the forefront of a transformative shift in the industry. By bringing diverse skill sets, backgrounds, and perspectives to the newsroom, they challenge long-standing assumptions about what journalism is, how it should be practiced, and who has the authority to shape its future.

Through their innovative approaches to storytelling, data visualization, and audience engagement, interactive journalists are pushing the boundaries of what is possible in journalism. However, as they negotiate their roles and identities within legacy news organizations, they often encounter resistance, misunderstanding, and conflict with colleagues who adhere to more traditional journalistic norms and values.

By examining these tensions and the ways in which interactive journalists navigate them, this dissertation sheds light on the broader struggle to redefine journalism's core principles and practices in an era of unprecedented change. It highlights the need for news organizations to foster a culture of experimentation, collaboration, and mutual understanding as they seek to integrate new forms of journalism into their existing frameworks.

Moreover, the experiences of interactive journalists offer valuable insights into the future of the profession as a whole. As the demand for data-driven, visually compelling, and interactive storytelling grows, the skills and perspectives of interactive journalists are likely to become increasingly central to the practice of journalism. By understanding the challenges and opportunities they face, we can better prepare future generations of journalists to thrive in a rapidly evolving media landscape.

By examining the entry points, motivations, roles, and challenges of these pioneers, I aim to shed light on the complex process of redefining what it means to be a journalist in the digital age. The stories and perspectives of interactive journalists highlight the paramount importance of adaptability, interdisciplinary collaboration, and a willingness to question long-held assumptions about the nature of the journalistic craft. As the field of journalism grapples with the need to remain relevant and effective in a constantly evolving media landscape, the experiences of interactive journalists provide valuable insights into the challenges and opportunities involved in recalibrating the profession's core values and practices to meet the demands of the 21st century.

Ultimately, this dissertation argues that the experiences of interactive journalists are not merely a niche concern but rather a critical lens through which to examine the fundamental questions facing journalism today. By illuminating the ongoing negotiation of journalism's values, practices, and professional identities, it contributes to a deeper understanding of how the profession can adapt and remain relevant in the face of technological and societal change.

Methods

This qualitative project aimed to answer the following research questions:

RQ1: What are the points of entry and motivations that lead people to pursue the path of interactive journalism?

RQ2: How do interactive journalists negotiate their careers, roles, and challenges in the newsroom?

Sampling

For this study, I employed a purposeful sampling method to recruit interviewees. The primary goal was to understand interactive journalists who had established themselves in the industry and to gain insights from "ideal" or premier interactive journalists. Studying premier interactive journalists offers several key advantages and rationales.

Firstly, identifying interactive journalists can be a challenging task due to the diverse range of titles and roles they hold within the industry. Interactive journalists may work under various job titles such as data journalist, multimedia journalist, or news application developer, making it difficult to pinpoint them without extensive research. One approach to finding interactive journalists would be to manually search for projects and identify the individuals who worked on them, or to scan professional networking platforms like LinkedIn for specific roles and job titles. However, this process can be time-consuming and may not guarantee a comprehensive or accurate representation of the field.

To overcome this challenge, I utilized the Sigma Awards website (<https://www.sigmaawards.org/about/>), which lists individuals who have nominated themselves for the Data Journalist of the Year award. Every year, the Sigma Data Journalism Awards recognize outstanding data journalism from around the world in two categories: stories and data journalists with the most impactful portfolios. By focusing on shortlisted candidates (of budding

data journalists) and (story) winners from the years 2020, 2021, and 2022, I was able to identify a group of 37 premier interactive journalists who had already been vetted by industry experts. This approach saved considerable time and effort in the recruitment process while ensuring that the sample consisted of individuals who had demonstrated excellence in their field.

I am confident in my sample selection process for several reasons. Firstly, in the industry, people still use data journalism as a catch-all term for all visual projects, no matter how technically different their creation processes may be. This means that the journalism awards also include interactive journalism stories. I went through all the three years' awards to find projects with heavy interactive elements, trying to sift out visualizations that could be produced using popular visualization tools like Tableau, which do not require very in-depth technical skills. Once I found these interactive stories, I looked at their bylines to identify interactive journalists within the mix. Secondly, there are no specific awards or recognition for "interactive" journalism stories, so the closest we get is with the data journalism awards. By focusing on the Sigma Awards, which are highly respected in the field, I was able to identify a sample of interactive journalists who have been recognized for their exceptional work by industry experts.

Studying premier interactive journalists provides an opportunity to learn from the best practices and experiences of those at the forefront of the profession. These individuals have not only mastered the technical skills required for interactive journalism but have also successfully navigated the challenges and opportunities within the industry. By understanding their workflows, collaborative processes, and perspectives on the field, we can gain valuable insights into what sets them apart and drives their success. This knowledge can inform the development of best practices, educational curricula, and professional development initiatives for current and aspiring interactive journalists.

Additionally, premier interactive journalists are likely to have a more comprehensive understanding of the industry's trajectory and the key issues shaping its future. As leaders in their field, they have witnessed the evolution of interactive journalism and have played a role in pushing the boundaries of what is possible. Their insights can help identify emerging trends, potential roadblocks, and areas for growth and innovation within the profession. By tapping into their expertise, we can gain a clearer picture of where interactive journalism is headed and what skills and strategies will be critical for success in the years to come.

From the initial list of 37 interactive journalists, I was able to find contact details for 31 individuals. Out of these 31 potential interviewees, 24 responded positively to my request, forming the final interviewee list for this study.

For the content analysis portion of the study, I examined the bylines of 20 English-language data journalism projects that had won awards. This analysis identified 57 interactive journalists who collaborated with various journalism and technology teams. To focus on individuals who were deeply embedded in the newsroom culture and workflows, I narrowed the list down to 42 interactive journalists who were full-time employees in the newsrooms, excluding freelancers and temporary collaborators. From this refined list, I searched for their LinkedIn profiles to gather more information about their backgrounds and experiences. However, I found that only 18 interactive journalists had LinkedIn profiles with coherent and English-language information. About a dozen of the profiles were in languages other than English, which I could not understand, limiting my ability to include them in the analysis. As a result, the content analysis focused on the 18 individuals who met the definition of an interactive journalist and had accessible LinkedIn profiles.

To ensure a well-rounded understanding of the field, I paid close attention to the stratification of the sample based on the regions in which the interactive journalists worked and the size of the organizations they were employed by (Arksey & Knight, 1999). By creating a table with these demographic variables, and although the respondents are skewed towards the US, other regions are well represented, helping to avoid confounders in the data.

With a target of 20-25 interactive journalists, I aimed to have no more than 50 percent of the sample be US-based journalists. I also stratified the sample based on the size of the organization they worked for (small, medium, or large). When recruiting participants, I adhered to these targets, turning down potential participants if I had already fulfilled the quota for their demographic group. This approach allowed me to maintain a well-balanced sample that accurately represented the diversity within the field of interactive journalism in terms of geographic location and organizational size.

In this study, the sample size of 15-20 participants was determined based on considerations of range and saturation (Gubrium et al., 2012a). This approach ensures that the research captures a diverse array of perspectives and experiences while also reaching a point where additional data collection yields diminishing returns in terms of new insights. This approach is particularly well-suited to this research because it allows for an in-depth cultural exploration of the unique challenges, opportunities, and dynamics that interactive journalists encounter in their work. By focusing on a specific group of professionals, this dissertation can provide valuable insights into the broader trends and transformations occurring within the field of journalism.

This method is especially useful in situations where the total population of the group being studied is unknown, as is the case with interactive journalists. By carefully selecting

participants based on relevant criteria and ensuring a diverse range of experiences and backgrounds, this research generates findings that are both rich in detail and potentially transferable to other contexts. Figure 1.1 presents an infographic of where the interactive journalists in this study were based (country). Figure 1.2 presents the distribution of sample characteristics, demonstrating the diversity of the participants included in this study. While not statistically representative, this sample provides a robust foundation for exploring the experiences of interactive journalists and generating meaningful insights into the changing nature of journalism in the digital age. A full list of interviewees with their names, countries, and organizations is available in Appendix B.

Figure 1.1: Where are the interactive journalists in this study?

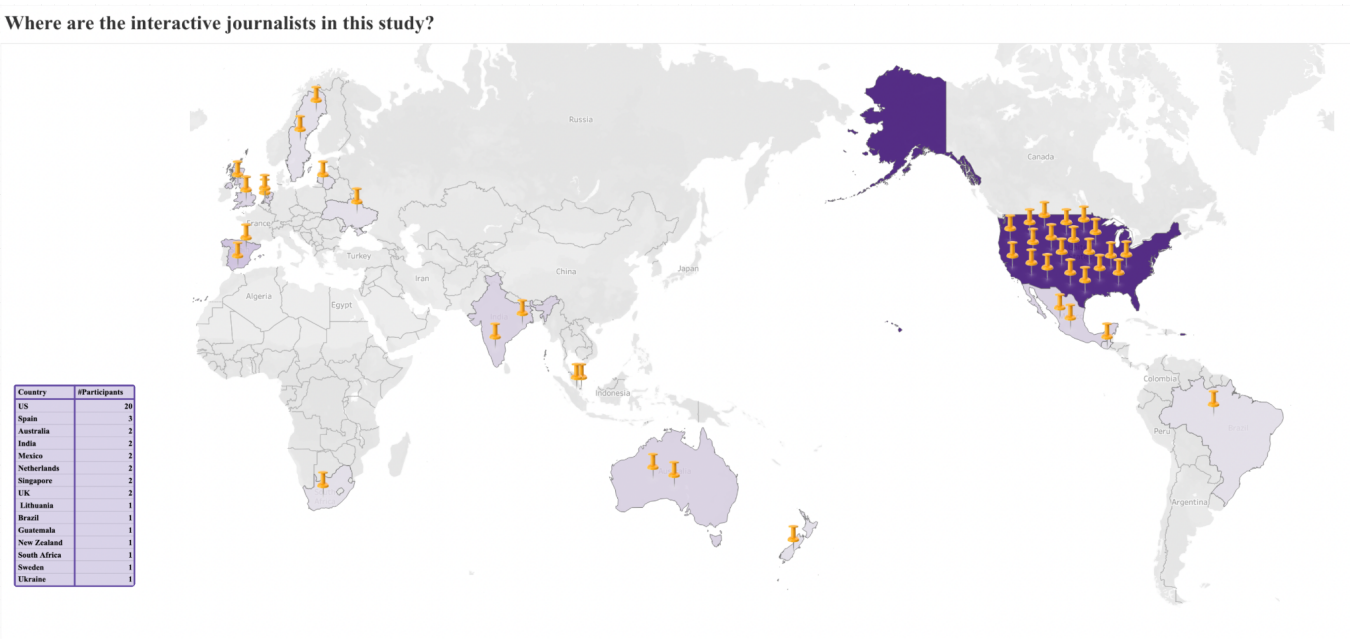


Figure 1.2: Distribution Of Sample Characteristics

Backgrounds	
-------------	--

Journalism	16
CS/Design	13
Hybrid	2
Other	11
Region	
North America	22
Europe	10
Asia	4
Oceania	3
Central America	1
South America	1
Africa	1
Newsroom Type	
Small/Startup	10
Medium	4
Large/Legacy	28

Data Collection

This mixed qualitative method dissertation combined data from in-depth interviews and content analysis of interactive journalists' LinkedIn profiles. The following sections describe the data collection and analysis process for both of these stages of research.

1. Interviews

I completed the interviews in two stages. The first was a pilot of my research questions. In this phase, I interviewed four interactive journalists to refine my interview questions and ensure I was getting the kind and depth of responses that I was looking for. In the second phase, I interviewed 20 interactive journalists using the questions I refined from the first phase. I will

now describe my sampling process and provide evidence for why I chose this method and my analysis procedure.

To conduct my in-depth, semi-structured interviews with interactive journalists, I used a stratified, purposeful, snowball sampling method. Interviewing was an appropriate method for these aspects of my research questions because I was interested in learning about participants' subjective understanding of their work (Lindlof & Taylor, 2017). While conducting qualitative surveys with open-ended questions or participant observation, or ethnography might also be used to answer my questions, none of these approaches was entirely appropriate to grasp the nuances of the norms related to such interdisciplinary teams of journalists and technologists. One of the main strengths of conducting a survey is its rigidity and consistency across all participants, which lends itself well to large sample sizes to make generalizable claims. What surveys gain in breadth, they lack in depth, and the conformity of all questions across each participant would have done more harm than good in the pursuit of answers about norms, practice, and tensions in the newsroom. I needed to ask different follow-up questions based on the answers to the previous questions, and that ability was afforded only in interviews. Some degree of flexibility in the phrasing and asking of questions, especially because interactive journalists come from different backgrounds and entry points into this field, also increased understanding between interviewer and interviewee.

In the interviews, the questions addressed the processes of producing interactive content, what best practices their news organizations followed to create these story types, how these may be different depending on the organization, and what tensions arose in the creation of such interactives. I also asked questions about their professional and educational background, why and how they got into interactive journalism and what they saw as their career path or opportunities

for advancement. I requested that they not only answer these particular inquiries but also share details about their typical daily habits and practices, specifying the ones that played a role in their story-building process and explaining how this process unfolded (Seidman, 2006; Brinkmann & Kvale, 2015). I asked them to describe a recent project in more depth and talk about how they produced it from inception to execution. Each interview lasted between 60-90 minutes and was conducted on Zoom because it allowed for recording and cloud storage, making post-interview processing easier (Archibald et al., 2019). Another benefit of using Zoom was that it allowed international meetings, and since interactive journalists are spread across the globe and this was a global project, Zoom's ability to facilitate international meetings was very appealing. Although Zoom offers a transcription feature, it is not as accurate as other products, so I used otter.ai to transcribe my interviews. With otter.ai, I transcribed the audio (.mp3) files after the interview was conducted. With all AI transcription services like Zoom and otter.ai, there is a range of accuracies, and I fixed the transcription errors from every transcript.

2. Content Analysis

I analyzed the online profiles and backgrounds of 42 interactive journalists to understand their education and career trajectories. This analysis points to their entry points into journalism and how they have maneuvered possibly different roles, and overall, their careers within the field of interactive journalism. I searched for their online profiles using LinkedIn. This gave information about their backgrounds - education, experience, and how they got into interactive journalism.

Data Analysis

I used inductive thematic analysis to analyze data from the interviews and content analysis, and my analytical method for both the interviews and the content analysis used the same theoretical orientation and analysis procedure. Inductive analysis is an emergent, "bottoms up" analysis that lets the data "speak for itself." Thematic analysis has been described as a valuable method of analyzing qualitative data for researchers, facilitating the organization of data, and capturing valuable information (Braun & Clarke, 2006). Braun and Clarke (2006) note its flexibility in analyzing rich data and offer a guide for using this analysis method. It also enables the researcher to organize and analyze responses and interpret them to determine common perspectives among participants (Creswell & Poth, 2016).

Thematic inductive analysis generates "themes" and is influenced by grounded theory (Glaser & Strauss, 2017), which is a systematic methodology involving the construction of theories through methodical gathering and analysis of data (Charmaz, 2014). Grounded theory is a qualitative research approach that aims to develop a theory that is grounded in the data collected and analyzed (Corbin & Strauss, 2014). This approach involves a constant comparative method, where the researcher simultaneously collects, codes, and analyzes data, allowing the theory to emerge from the data rather than being imposed upon it (Charmaz, 2014). The process involves open coding, where the researcher identifies and categorizes concepts in the data, followed by axial coding, where the relationships between categories are explored and refined (Corbin & Strauss, 2014). The final stage is selective coding, where the core category is identified, and a theory is developed that integrates all the categories (Glaser & Strauss, 2017).

Grounded theory involves various steps throughout the process. The first step occurred during the interviewing process itself and consisted of notes and memos that attempt to create types that accurately characterize multiple cases (Glaser & Strauss, 2017). The defining and redefining process was ongoing throughout the interview phase because it allowed me to refine interview questions or ask respondents for follow-up interviews if needed for a deeper discussion about the main point. This is why I did four pilot interviews to validate, refine and craft my interview protocol so I could be assured the questions had a high yield of the kind of information I was hoping to gain from interviewing these professionals. One way to develop themes was to ask respondents questions that asked them to describe how they might group like cases (Rubin & Rubin, 2005). For example, if I began to notice a theme, identified through the coding process, that I tentatively labeled "no common language issues," compiled of cases where interactive journalism teams struggled in the newsroom because they all did not speak the same professional language, I could ask participants to provide an example of what they considered a "no common language issues" story, or even the opposite, which might be a story about issues around being too similar and "too similar in ideas issues" or "unhealthy competition issues."

There were two factors I used to determine when the iterative process of creating codes and themes was finished, or in other words, when I had reached data saturation. First, based on the available data, the themes had to be broad enough to provide a generalized account of most of the different norms associated with the production of interactive journalism, and second, they had to be specific enough that they accurately represented individual cases. Thematic analysis, which is driven by the coding process and watching themes emerge from the data, accommodated analysis for entry points into interactive journalism and perceptions about journalism, and I also coded for information regarding roles and challenges in the newsroom.

Data saturation was reached by the 20th interview, as I started hearing repeating themes from the respondents. However, to ensure saturation was fully achieved, I continued scheduling interviews. After conducting a total of 24 interviews, it became evident that no new themes or information were emerging, confirming that data saturation had been reached. Therefore, I concluded data collection at the 24th interview. Once the initial codes and themes were built, I compared and contrasted the existing themes to see if there were everyday routines and issues for a certain kind of interactive journalist or within a certain kind of organization. I examined the similarities, the differences, and the relationships or associations between them. Coding was a staged process; codes were assigned, then re-assigned to form themes. Like codes were grouped together (Gubrium et al., 2012b), and in this way, themes were created.

My interviews with participants provided material for inductive thematic analysis, and the stories I elicited from participants added depth and richness to my research (Arksey, 1999). I do not think my methodological choice of qualitative interviews and content analysis exhausted the options for studying who interactive journalists are and how they collaborate with programmers, journalists, or both, in interactive teams, but being able to dig deep with semi-structured interviews offered unique and valuable insights. For example, understanding how a shared language of norms and values emerges within interactive teams relates to social field position (Benson, 2006) made it possible to see how the strategies for such collaborations can be created or enhanced for the future. It added depth to the concept of the perceptions of changing doxa of future journalists by beginning to understand who follows, replicates, or resists these norms or routines and how some of these emerging ones are negotiated.

Coding and Theme Building

I employed Computer Assisted Qualitative Data Analysis (CAQDAS) software to facilitate the coding and theme-building process, which is a standard practice in qualitative data analysis (Carcary, 2011). The software offered numerous benefits, including code annotations, qualitative comparative analysis, data coding, and even quantitative data analysis and data visualizations. By utilizing CAQDAS, I was able to conduct transcription analysis, coding and text interpretation, and discourse analysis, all of which contributed to the development of an inductive thematic analysis.

Analysis

The use of CAQDAS significantly enhanced the validity of my research. While I primarily used the software for the development of themes and codes, having access to basic quantitative data analysis for describing my sample was also crucial. For this study, I chose Dedoose (publisher) software, an online, shareable, and affordable option for powerful qualitative data analysis. As an online tool, Dedoose allows multiple users to access the project, which was particularly beneficial for collaboration with my committee. The software is intuitive and accessible from any computer worldwide.

Predictive Analytics Today, a website dedicated to data analytical professionals, gave Dedoose a score of 8.4 out of 10. It is important to note that I did not use the most widely-used analysis software, such as NVivo (rated 9.5 by Predictive Analytics Today) or Atlas.ti (rated 8.8). Although NVivo and Atlas.ti have been the leaders in CAQDAS since the inception of this kind of analytical tool in the late 1980s, with Atlas.ti first used in 1989, Dedoose is a more recent addition, having been first used in academic projects about ten years later. However, I chose

Dedoose for its collaborative, online, and easy-to-use interface, high-quality documentation, and affordability.

Structure of the Dissertation

The findings, organized into three findings chapters, each address a different facet of what it means to be an interactive journalist. Chapter 2, "Who is an Interactive Journalist?", delves into the entry points, motivations, and career trajectories that led people into interactive journalism. This chapter utilizes both interviews and content analysis of interactive journalists' LinkedIn profiles to paint a comprehensive picture of the paths these pioneers have taken. Chapter 3, "What do Interactive Journalists Do?", focuses on the functions and practices of interactive journalism in the newsroom. Through in-depth interviews, this chapter discusses the day-to-day realities of being an interactive journalist and how they perceive their role within the larger journalistic field. Chapter 4, "Newsroom Integration Challenges and How Interactive Journalists Navigate Them", examines the challenges interactive journalism teams or professionals face when integrating into the newsroom and collaborating with more traditional journalists and editors. Drawing on interviews, this chapter sheds light on the tensions that arise and the strategies interactive journalists employ to navigate these challenges. Chapter 5 concludes this dissertation by presenting a taxonomy I have developed to categorize the various types of interactive journalists based on the synthesis of the findings of my research. It also provides a summary of the key insights from this study, discusses the implications of these findings for the field of journalism, and offers suggestions for future research directions that can build upon the groundwork laid by this dissertation.

CHAPTER 2: WHO IS AN INTERACTIVE JOURNALIST?

I. Introduction

As I defined in the previous chapter (Chapter 1, p. 6), an interactive journalist is "*a professional who combines their commitment for journalism with their expertise in programming, data analysis, and design to craft innovative, impactful, and memorable stories that shape public discourse.*" In other words, they are tech-savvy storytellers who, driven by their commitment to the profession despite challenges and drawbacks, use their diverse skill sets to create compelling narratives pushing traditional journalism's boundaries in the digital age.

But who *really are* these interactive journalists? What motivates them to pursue this unconventional path? How do they navigate the challenges of a rapidly evolving field? To answer these questions, I explore the stories behind the storytellers to understand the identities, backgrounds, and experiences that shape the world of interactive journalism.

Through a combination of interviews with 24 professionals and analysis of their LinkedIn profiles, and also including those of 18 additional data journalism award winners (The Sigma Awards) from the past four years, I sought to paint a vivid portrait of the interactive journalists at the forefront of this emerging field. The qualitative data collected in this study provided valuable insights into the varied backgrounds, motivations, and challenges that shape the experiences of interactive journalists.

The path to becoming an interactive journalist is varied, with professionals from diverse educational and professional backgrounds entering the field. While some have followed the traditional route of earning degrees in journalism or communication, others have transitioned

into interactive roles with backgrounds in fields such as design, computer science, engineering, data science, or social sciences. This chapter explores the diverse starting points and professional trajectories of interactive journalists. Examining their educational backgrounds and career paths sheds light on the interdisciplinary nature of the field and the varied skills and perspectives that contribute to the creation of interactive journalism projects. This research also suggests that the motivations driving interactive journalists are as diverse as their backgrounds. Some are inspired by the groundbreaking work of pioneers in the field, while others are driven by a deep love for technology and a desire to harness its power to create more engaging and informative journalism. Many have had formative experiences early in their lives that have sparked their passion for interactive journalism and set them on a path to pursue it professionally.

As I delved deeper into the career trajectories of interactive journalists, specific categories emerged based on when they entered the field. Early practitioners, with 0-4 years of experience before making the transition, often begin their careers through internships or junior roles and quickly adapt to the rapidly evolving landscape. Mid-career pivoters, with 5-9 years of experience before the switch, bring valuable expertise from their previous roles and tend to take on more specialized positions within interactive journalism. Late-career pivoters with 10+ years of experience before making the transition often enter interactive journalism roles later in their careers. Some late-career pivoters rise to leadership positions, guiding their teams to create impactful projects. Others pursue entrepreneurship, founding startups, or collaborating with like-minded professionals to create innovative solutions to the challenges facing journalism today. Many interactive journalists tend to teach, sharing their knowledge and experience with the next generation of interactive journalists, helping to shape the future of the field.

Through the stories and experiences of the interactive journalists featured in this chapter, we gain a deeper understanding of the identities, motivations, and challenges that shape this dynamic field. The observations here about life as an interactive journalist point to potential areas of friction between the experts of this new form of journalism and the staff of more traditional newsrooms. The tasks that interactive journalists must perform are different in crucial ways from those of traditional journalists, and sometimes, these roles chafe against each other. Chapter 4 of this dissertation will explore these tensions in detail, but understanding the daily lives of these professionals is key to understanding how these specialists conflict with other, more traditional journalists.

II. Literature Review

The career paths of traditional print journalists have been extensively studied and documented (Lowrey & Daniels, 2017). However, the emergence of interactive journalism has given rise to new roles and skill sets, leading to potentially distinct career trajectories for professionals in this field (Kosterich & Weber, 2019). Interactive journalists face unique challenges and opportunities as they navigate the rapidly evolving digital journalism landscape, which may differ from their traditional counterparts. This chapter explores interactive journalists' career paths, roles, and experiences, shedding light on the factors shaping their professional journeys and their impact on their work newsrooms.

Journalism training, particularly interactive or computational journalism, can start as early as middle school (Wolz et al., 2011). One program aimed at increasing the number of students entering the computing field held a summer session combining computing and

journalism to create a school magazine (Wolz et al., 2011). The digitalization of media and the rise of interactive journalism has required a shift in the kinds of skills journalists need to be successful in the newsroom (Royal & Kiesow, 2021). The "new" journalist needs skills in coordinating, developing, managing, and supporting the new digital product (Royal & Kiesow, 2021), and to develop these skills, a journalist needs a new career path (Usher, 2016). Before the era of big data journalism, journalists needed academic instruction in journalism and, armed with a bachelor's degree in journalism, could get jobs in small newsrooms and slowly work their way up the ranks. However, the new journalism requires not only journalism training but also computational training (ProPublica's Data Journalism: How Multidisciplinary Teams and Hybrid Profiles Create Impactful Data Stories. - Document - Gale OneFile: Communications and Mass Media, n.d.; Wolz et al., 2011).

Despite interactive journalism being a relatively new entrant to the profession, scholars have already developed a considerable body of knowledge about it. Importantly, they have recognized that there are many entry points into a career in interactive journalism, and each of these pathways exposes journalists to different professional norms. Usher (2016) classified interactive journalists into three groups based on their backgrounds and entry points: hacker journalists, programmer journalists, and data journalists.

Hacker journalists, who usually self-identify as technologists, commonly come from a technology or STEM background. They enjoy telling stories through code and see "hacking" the news as a way to build something for the common good (Parasie, 2011). Within the newsroom, they are treated as skilled experts and do not need to learn or unlearn anything to change how technology is used in the editorial process. They are often seen as "messiahs" with the potential to help journalism adapt to the needs and expectations of the digital era. Their norms and values

will likely be predominantly technology-related, such as collaboration, open source, shareability of stories across mediums, and audience engagement (Parasie, 2011; Usher, 2016).

Programmer journalists, the second type of interactive journalist, come from journalism or humanities-based backgrounds such as communication, sociology, political science, or literature and have no prior exposure to code (Fink & Anderson, 2015). They began as journalists and gradually acquired data skills as they became helpful for particular stories (Fink & Anderson, 2015). Their primary self-conception is that of a journalist. Programmer journalists understand the importance of the story and established news values, which are the central focus for any journalist, and they always work in service of these values.

Usher (2016) documented that the third kind of interactive journalist was a data journalist, but this concept, though only six years old, is prematurely outdated because few journalists today can claim not to use some form of data in their reporting – be it graphs, charts, or publicly available data -- making most journalists data journalists. Data journalism is now the dominant form of journalism, and although there are few opportunities for hybrid roles, journalists, technologists, and programmers have close interactions and collaborations. Instead of Usher's (2016) third categorization of the data journalist, the third kind of interactive journalist that I propose here is the hybrid journalist. The speed at which new forms and norms are being shaped in interactive journalism bolsters my argument for the need for new professional labeling and norms identification to understand where journalism is headed in the future. While all the previous arguments suggest the entry points into interactive journalism for different data journalism specialists, not much has been said about the hybridity in the backgrounds of a hybrid journalist (Splendore & Brambilla, 2021).

A new strand of scholarly literature dealing with the concept of hybrid journalism (Splendore & Brambilla, 2021) and the rise of the computational journalist (Diakopoulos, 2016), who generally has education and experience in both technology and journalism, challenges the dated notion that data journalism is a subset of interactive journalism, and that instead, the third kind of interactive journalist is a hybrid journalist. Berrett and Phillips (2016) showed that about half of American journalism students have an opportunity to specialize in some form of interactive or data journalism during journalism school. Their study (Berrett & Phillips, 2016) showed that among 113 American journalism school programs, 59 offered some form of computational skill development for students. While at least one computational course was offered in 56 programs, two or more such courses were offered in 32 programs, and three or more courses were offered in 18 programs. Supporting their data (Berrett & Phillips, 2016), which shows that many journalism students are being trained to become hybrid journalists, Hannaford (2015) suggests that besides the variety of massive open online courses (MOOCs) available for interested students online, some journalism schools even have dual degrees in computer science and journalism. Some offer specialization in interactive journalism, which can lead to computational journalism-related jobs for its students, making it even easier for students to pick a track that makes them proficient in journalism and computation (Hannaford, 2015). For example, the MA in interactive journalism offered at the City University of London, led by James Ball and Paul Bradshaw, with consultation from Simor Rodgers, all pioneers in the field, had 36 graduates in the years 2015 and 2016, out of which 11 went on to become interactive, or data journalists, and eight others entered data-related roles in other fields. Programs like the University of London's interactive journalism track and data from the US show that at least half of journalism students have access to hybrid training. Berrett and Phillips (2016) support the

concept that the “new” third kind of interactive journalist is a hybrid journalist -- or a Journalist 2.0 as some call it (Caswell & Dörr, 2018). This new breed of journalist has backgrounds in both technology and journalism and has a hybrid set of norms and values that may or may not be a derivative of prevalent journalistic norms.

Interactive journalists, whether working as part of multidisciplinary teams or as individuals with diverse backgrounds, tend to have different sets of norms and values that are influenced by their unique paths into the field of interactive journalism. Different kinds of journalists have different values and norms (Witschge & Nygren, 2009). However, this literature review also highlights a lacuna in the literature when it comes to the predominant norms and values associated with interactive journalism. Usher (2016) argues that traditional journalism norms continue to dominate because of institutional factors, including how these products, procedures, and teams are designed and situated. Identifying the norms and values of interactive journalists and how these values shaped why these journalists chose to specialize in interactive journalism is a primary theme of this chapter.

The rapid pace at which new forms and norms emerge in interactive journalism underscores the need for new professional labels and the identification of practices to understand the future direction of journalism. While the previous arguments suggest the entry points into interactive journalism for different data journalism specialists, little has been said about the hybridity in the backgrounds of hybrid journalists (Splendore & Brambilla, 2021).

To better understand the diverse backgrounds and perspectives of interactive journalists, I investigated how their different entry points into the field shape the professional norms and values they bring to their work. By examining the unique paths that lead individuals to become interactive journalists, this study aims to shed light on the complex dynamics that emerge when

professionals with varying skill sets, experiences, and cultural frameworks collaborate within the rapidly evolving landscape of digital journalism. This means that the product of interactive journalism has incorporated these "emerging norms" or "new rules" (Usher, 2016), and it was important to know what they are. How do the motivations to get into journalism differ for people from technology backgrounds compared to traditional journalists? Are certain ethics more prevalent in traditional journalists compared to interactive journalists? Do specific kinds of interactive journalists tend to follow particular career paths? These questions are addressed in this chapter.

The norms and values of interactive journalism are linked to an interactive journalist's motivation to enter the field. On the one hand, scholars (Hermida & Young, 2017; Usher, 2016) suggest that various entry points into interactive journalism, such as whether the interactive journalist has more of a computer science, social science, or journalism background, leads to disciplinary "degrees of mixing." Thus, these journalists are exposed to various sets of norms and values. The norms and values from their disciplinary training are then brought into the newsroom, where they mix, and sometimes collide, with existing journalistic norms. They also point to how the product of interactive journalism has been pressured into following existing norms and values of journalism because "journalists have the final say" in this hierarchy of blending.

Similarly, scholars like Mathias-Felipe de-Lima-Santos (2022) argue that good interactive journalism can be produced by hybrid and multidisciplinary teams, or people with a hybrid of technology and journalism backgrounds. On the other hand, scholars such as Holovaty (2009), Usher (2016), and Strombäck (2009) contend that journalists and programmers must be considered the same when it comes to their motivations for participating in journalism, as they

function in similar ways and are part of similar cultural institutions. However, they also note how traditional journalistic norms and values are imposed onto technologists in the newsroom. Usher (2016) and Coddington (2015) highlight some new values and norms emerging during the production of interactive journalism (Lewis & Westlund, 2015). These values impact journalism's epistemology, expertise, economics, and ethics (Lewis & Westlund, 2015) and may drive some motivation to become an interactive journalist.

III. Findings

Interactive Journalists Have Varied Backgrounds

The analysis of interactive journalists' educational foundations and professional trajectories showed a multiplicity of backgrounds that contribute to the composition of this field. While some hail from traditional journalism and communication educational pathways before pivoting into interactive roles later in their careers, others arrive with formal training in design-oriented disciplines like architecture, cartography, and visual arts. Additionally, a segment possesses technical backgrounds in computer science, engineering, or data science. Though less prominent, a subset emerged from social science academic paths before entering interactive journalism. This variety reflects the interdisciplinary nature of the profession, integrating individuals with both humanities-driven and technically-focused previous experiences. In this section, I explore the professional backgrounds of interactive journalists and analyze for this research, categorized broadly into journalism, design, computer science, and other social science academic and professional pathways.

Journalism Background

Interactive journalists often have a formal education in journalism or communication, complemented by professional experience in reporting, writing, and various communications roles. Individuals with this background may transition from traditional journalism jobs into interactive roles. For instance, Gilberto Scofield Jr., a Director of Online Journalism at Agência Lupa in Rio de Janeiro, Brazil, obtained an undergraduate degree in Communication and Journalism from Universidade Gama Filho, a Brazilian university in 1986. He held various communication-related positions over 34 years before transitioning to an interactive journalism role in 2021. Similarly, Eduard Martín-Borregón, a journalist based in Spain, completed an undergraduate degree in journalism in 2007 from Universitat Ramon Llull and became an interactive journalist in 2012, following five years in broadcast journalism as a TV Producer at Canal Terrassa Vallès in Terrassa, Spain.

Computer Science Background

A computer science background includes formal degrees in computer science, software engineering, or related technical fields such as human-computer interaction, software engineering, or bioinformatics. These individuals have work experience in programming, data science, and software development. One example is David Cabo, an interactive journalist based in Madrid, Spain, who held a master's degree in software engineering from Universidad de Zaragoza, in Zaragoza, Spain and worked for 13 years as a software engineer before transitioning to interactive journalism and founding Civio. This Spanish nonprofit organization promotes anti-corruption, transparency, and accountability in government through data-driven and interactive investigative journalism.

Cabo's career trajectory suggests that data journalists with computer science backgrounds may be more likely to pursue entrepreneurial or startup-oriented paths, where their technical skills can be leveraged to create innovative data-driven solutions and apply their expertise to social causes and investigative journalism. Another example is Fernando Matzdorf, an interactive journalist with a computer science undergraduate degree from Universidad del Valle de Guatemala in Guatemala City, Guatemala worked at Mexico-based PODER, a data and interactive journalism startup. These examples suggest that interactive journalists with computer science backgrounds are well-equipped to work in fast-paced, innovative environments where their technical skills and ability to work with data are highly valued. Moreover, it is possible that startups and new ventures in journalism prioritize practical skills and the ability to deliver results over traditional journalism education or experience. This preference might stem from two possible reasons: first, the fast-paced and dynamic nature of these organizations, which demand adaptability and a strong focus on outcomes; and second, potentially less pressure to adhere to the journalistic standards of "legacy" media.

Design Background

Individuals with a design background have formal education in graphic design, architecture, geography, and cartography. Their work experience includes web development, UI/UX design, animations, and other visual design roles. Martín Szyszlican, a Mexico-city based web developer with 14 years of experience in UI/UX design and web development consulting, became a technical coordinator and interactive journalist at PODER in 2018. Similarly, Yuliya Parshina-Kottas, a US-based interactive journalist with an undergraduate degree in computer visual arts from School of Visual Arts, New York City, and ten years of experience in motion

animations and graphics design, transitioned to become an interactive and multimedia editor at The New York Times in 2012.

Other Backgrounds

Although less prevalent than backgrounds in journalism, design, and computer science, the analysis pointed out that some interactive journalists possess academic backgrounds in sociology or international relations. For instance, Rachael Dottle, a urban studies major and sociology minor, who got her undergraduate degree at Barnard College, New York City and graduated in 2016, worked as a sociology researcher in civic tech for two years before transitioning to a visual journalist role at FiveThirtyEight in 2017.

Interactive Journalists Forge Paths Through Education and Hands-On Experience

This section explores the primary entry points into interactive journalism careers, including internships, fellowships, and educational pathways, as well as the various methods through which these journalists acquire and develop the necessary skills for their work.

Internships and fellowships serve as crucial gateways into interactive journalism, providing aspiring journalists with opportunities to learn new skills and gain practical experience. Many aspiring journalists like Alex Lim began their careers as interns at prominent news organizations or media companies with well-established data or interactive desks, such as The New York Times, The Pudding, The Times (UK), or The Economist. These short-term opportunities, typically lasting three to six months, offer hands-on experience, exposure to industry professionals, and the chance to build a portfolio of work. In Lim's case, a summer

internship as a data reporter at The New York Times sparked his interest in contributing technically to news organizations, eventually leading to interactive journalism roles at Stuff and The Straits Times. Reflecting on this journey, he said:

I took part in Northeastern's Co-op program, which is like a six-month internship program spread out over the course of your degree, so I did three, six-month internships, and kind of through each of those, I made my way to the interactive graphics journalism space. Through that process of trial and error through three separate like very different internships, I kind of honed in on this area. I figured I liked it.

While internships are often unpaid or poorly compensated, they provide valuable learning experiences that can help aspiring interactive journalists develop the skills necessary to succeed in the field. Some, like Adrián Blanco Ramos, complete multiple internships before landing a permanent role. Before securing a full-time position as a data and interactive journalist at El Confidencial in Madrid, Spain, Ramos completed a series of internships throughout the year at various media organizations, including TVE in Madrid, Spain, The Times in London, UK, The Slow Journalism Company in London, UK, and Agencia EFE's London, UK bureau. However, research indicates the prevalence of unpaid internships creates significant barriers for students without financial means to take on such unpaid work (Salamon, 2015). This highlights the competitive nature of the field and the persistence, and possibly financial resources, often required to establish a career in interactive journalism.

Fellowships, such as the Knight Fellowship at Stanford University and the Nieman Fellowship at Harvard University in Cambridge, US, are popular among mid-career professionals seeking to pivot into interactive journalism. These residential programs, lasting around ten months, offer journalists the opportunity to enhance their skills, adapt to industry

changes, and gain access to invaluable resources and networks. However, securing a fellowship often requires a decorated professional background and the trust of one's employer to grant an extended leave. Organizations or academic institutions that offer fellowships invest in the selected journalists, providing them with the resources and time to study, experiment, and explore new territories within the field. Tristan Ahtone's career trajectory exemplifies how journalists can leverage fellowships to shift their focus toward data and investigative reporting. With an academic background in creative writing and broadcast journalism, Ahtone worked as a reporter for over a decade at US-based organizations like NPR and Al Jazeera America. In 2016, he pursued the Nieman Fellowship to advance his skills in data investigations. Following the fellowship, Ahtone took on editorial roles at High Country News, The Texas Observer, and Grist, where he currently focuses on data-driven and interactive investigative stories.

The data from the interviews and content analysis suggests a potential uptick in interactive journalists joining the field from 2010-2018. This trend aligns with the introduction of new educational programs and courses focused on interactive journalism during the same timeframe. For example, the City University of London launched an MA program in Interactive Journalism in 2011 to equip students with the skills needed to thrive in the evolving media landscape. Similarly, between 2012 and 2014, US-based institutions such as Columbia University In New York City, and Northwestern University in Evanston, Illinois, introduced journalism programs that offered a combined master's degree, bridging the gap between their journalism and computer science schools. The emergence of these educational initiatives during the 2010s likely contributed to the influx of new talent in interactive journalism, with professionals joining established news outlets and emerging startups. It is also possible that the relationship between the increase in interactive journalists and the introduction of new

educational programs is a chicken-and-egg scenario, where the demand for interactive journalists might have driven the creation of these programs, rather than the other way around.

For those without secure internships or fellowships, acquiring interactive journalism skills often involves pursuing specialized education or training. Some aspiring interactive journalists pay for school and enroll in interactive journalism degree programs or related fields such as data journalism or computational journalism. Others opt for certifications or online courses to develop the necessary skills. While these educational pathways may not serve as direct entry points into the field, they prepare individuals to seek entry-level jobs or propose more interactive projects, gradually transitioning into an interactive journalism role.

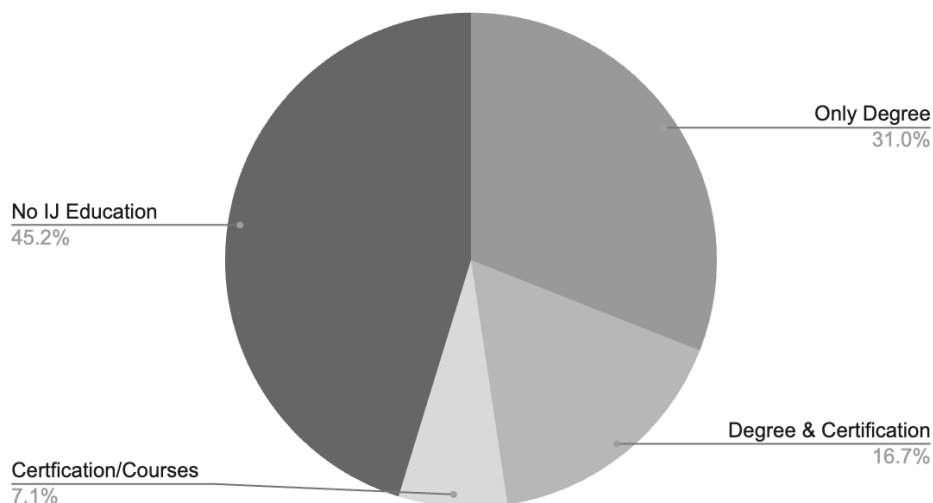
For example, Youyou Zhou holds a degree in convergence journalism from the University of Missouri, in Columbia, Missouri, which blends visual design and journalism, equipping her with data visualization skills and core journalism foundations. She says, "I believe it is a blend of my journalism education, data analysis skills, and frontend coding skills that prepared me for this career." Zhou also enrolled in various Coursera courses in Python and general computing before transitioning into an Interactive News Developer role at Associated Press in 2014, demonstrating the importance of online courses and certification programs in developing interactive journalism skills. Similarly, Cape Town, South Africa-based Christopher Udemans, who currently works as a digital graphics journalist for The Straits Times, completed 19 different MOOCs on data science, Python, HTML/CSS, and web scraping before 2018 when he decided to make the shift to become an interactive journalist. Because of his love of working with data, he recently registered for an online master's program in data science at the University of London in 2022 to further enhance his technical skills. Udemans explains:

I suppose more of the focus [at Straits Times] is on graphics, but my first love is dealing with the data side of things. I love visualizing, but I much prefer digging into the data, trying to find stories in it. I also started getting into things like machine learning. And so, I'm also doing a master's in data science at the moment.

The prevalence of internships, fellowships, and specialized educational programs as entry points into interactive journalism underscores the importance of acquiring the necessary skills to succeed. Continuous learning and updating skills, however, are equally crucial in this rapidly evolving field. As technology advances, interactive journalists must stay up-to-date through workshops, conferences, online resources, and experimentation to remain competitive and produce cutting-edge work. Interactive journalists employ various methods to develop their expertise, including formal education, online courses, and self-learning (see Figure 2.1).

Figure 2.1: Interactive Journalists Education Pathways

IJ Related Education



The interviews also suggest that interactive journalists possess an array of technical skills, categorized into six main areas: programming languages, frameworks and libraries, data analysis and visualization tools, content management systems (CMS), design and multimedia tools, and other skills and technologies. Figure 2.2 provides a comprehensive overview of the specific skills mentioned by the participants in each category.

Figure 2.2: The Technical Skills Of Interactive Journalists

Programming Languages	Frameworks and Libraries	Data Analysis and Visualization Tools	Content Management Systems (CMS)	Design and Multimedia Tools
JavaScript Python R SQL HTML CSS PHP C++ C Java ActionScript	React D3.js jQuery	Google Sheets Microsoft Excel Libre Office Flourish Observable OpenRefine QGIS Blender (for 3D visualization)	WordPress Joomla	Adobe Illustrator Affinity Designer Canva

Understanding the prevalence of internships, fellowships, formal education and skills training as entry points into interactive journalism has important implications for the field's development. Educational institutions and news organizations can foster the growth of

interactive journalism by collaborating to develop internships and fellowship programs that provide immersive education and work experience, preparing participants for future roles as reporters or editors, depending on their experience level upon entry. By equipping aspiring interactive journalists with the necessary skills and knowledge through these entry points and various learning methods, the field can continue to attract and nurture talented professionals who will shape the future of interactive journalism.

Intrinsic Motivations: Passion Fuels Interactive Journalists' Pursuits

Analysis of in-depth interviews identify diverse motivations underpinning interactive journalists' pursuit of this field, from inspiration sparked by exposure to pioneers to an inherent love for technology and storytelling to early developmental factors seeding their interests. While shared intrinsic drives and personal journeys were the dominant impetus, pragmatic necessities like a need for immigration sponsorship drive some. This section unpacks the intrinsic, developmental, and external motivational forces propelling these professionals toward interactive journalism careers.

Sparkling the Flame: Influential People, Projects, and Personal Experiences

Some are inspired by exposure to innovative work in the field, like Manas Sharma, who highlighted, "I was just discovering Mike Bostock, what d3 is, and how he makes visualizations like a rent calculator." Others highlight inspirations from mentors and colleagues, such as Rebecca Pazos, who explained she "met someone working at the Sydney Morning Herald learning about code. We decided to work together on a census data project, and I fell in love with data storytelling and crunching the numbers." For Pazos, collaborating with a colleague on an

experimental census data project using new tools opened her eyes to the potential of data-driven storytelling. Some point to sparks of personal imagination, like Christopher Udemans, who said, "I happened upon Ben Fry's Python tutorials and did them to differentiate myself and get into data. So I have him to thank for the inspiration." Udemans highlighted how encountering coding tutorials aimed at journalists motivated him to improve his data analysis skills to pave his career path. Ellis Simani similarly highlighted being inspired to pursue data journalism after seeing an ambitious Seattle Times project called "Under Our Skin" that used multimedia storytelling to explore issues of race in Seattle. Simani described it as a "pretty ambitious project at the time looking at things like race and Seattle" and said, "I saw that, and I was like, you know, this is pretty cool. It would be fun to work on, you know, bigger projects like this in the journalistic sense." These inspirations from exposure to innovative work influenced by mentors or colleagues and personal sparks of imagination ignite intrinsic curiosity to pursue interactive journalism.

Pioneers of Progress: Advancing Data Journalism in Emerging Markets

The section highlights the efforts of interactive journalists who are driving the growth and development of data journalism in countries where the field is still in its early stages, such as Japan, Nigeria, Spain, Singapore, and Romania. These individuals demonstrate leadership and entrepreneurial skills, often establishing and leading data journalism teams or even entire interactive desks within their organizations. For example, Pazos in Singapore states that "it is still a growing thing. It is still a new kind of journalism here. We are not the New York Times, so we don't attract the kind of talent or attention that they will get. So we need to build it almost from scratch here." His comments suggest that in some newsrooms interactive journalism is still relatively new. These individuals showcase leadership and entrepreneurial abilities, often leading

their own interactive journalism teams or spearheading the establishment of entire data journalism desks. Laura Aragón in Spain discusses how she created the first data journalism team in El Confidencial and grew it from herself to a team of four people. Through her leadership, she built up data journalism capabilities at her news organization. Similarly, Pazos describes how she and her husband were able to "get a little rogue team going. And we have just grown from there. So just that year-on-year basis, basically with the same structure of, although it is changing, again, the same structure of three people, but now we are 15." This pioneering spirit is not limited to specific regions - data journalism innovators worldwide are driven to advance the field in their countries. In Japan, the Isao Matsunami has pushed digital media to a country where print newspapers dominate. In Brazil, Luis Toledo was one of the first journalists to utilize freedom of information laws to access data for reporting. In South Africa, Udemans helped start a modest data journalism team in a country where such capabilities barely existed at media organizations. Across diverse contexts, these individuals exemplify the entrepreneurial attitude and determination to bring data journalism to uncharted territories.

The "Journalism Bug" - Intrinsic Motivation and Early Influences

Some describe an inherent "journalism bug" motivating them. This term symbolizes an intense, inherent drive toward journalism that supersedes financial motivation and alignment with journalistic values. As Lim stated, "It was not the money. It is like the fulfillment of doing important work." He indicates that the fulfillment and importance of the work, not financial gain, is his primary motivation. Early experiences can also spark this enduring passion and provide opportunities to gain valuable technical skills. Paul Schreiber explains how childhood experiences working on his high school and college newspapers provided early sparks that fed

his interest. Describing his experience joining the student paper Imprint at the University of Waterloo, Schreiber remembers coming to the paper's office as a newcomer and offering to help proofread issues. The staff responded, "They are like, well, we produce the newspapers on Wednesdays. You should come by, and you can help proofread things." Schreiber's commitment to journalism led to opportunities to write articles and reports, getting him hooked on journalism's reporting and writing aspects. Besides the early bloomers, the passion can also be ignited later in life. Simani explains how a summer internship in 2017 at the South Seattle Emerald, a Seattle, US based community paper focused on overlooked local issues, was enough to spark his interest in using data for civic issues. He remembers becoming fascinated with analyzing dangerous intersections using traffic data from Rainier Avenue, a major arterial with frequent crashes, recounting, "I remember I was really interested at the time and like transit data...And so I remember, like, the first kind of data idea I ever had was like, oh, like, how can I try and figure out like, you know, dangerous intersections along Rainier." This formative internship set him on a path to journalism. He interned at the Seattle Times and completed the LA Times' fellowship for young journalists from diverse backgrounds. He now works as a data reporter at ProPublica, blending his technical skills with his passion for journalism.

Coding Meets Storytelling: Blending Technical Skills and Journalistic Pursuits

Interests in mathematics, technology, and coding, combined with the desire to uncover meaningful insights and positively impact society, motivate people to pursue data journalism. Aendra Rheinstad, an interactive journalist at The Times (UK), with a background in computing starting from a young age with self-taught HTML and Linux skills, explained, "I've always been into computers and stuff. I had two interest spheres. On the one hand, I've always been into

technology, particularly web technologies, the internet, and journalism or writing-related stuff."

A prominent motivational theme is the opportunity to synthesize technical prowess with journalistic pursuits. For Sharma, who comes from a design background and discovered data journalism through election analysis internships, the process of "building things like visualizations and condense it or structured in a way that makes it easy, doable to understand really appealed to me" and "figuring out this complex visualization part" holds deep appeal. During his college internship covering the Tamil Nadu elections, he gained hands-on experience cleaning data, creating maps and charts, and building web pages with D3.js. This first taste of synthesizing design skills with journalistic analysis showed Sharma the potential of data journalism's blend of technology and storytelling. Through subsequent roles at organizations like The Washington Post, he continued honing his skills in interactive visualization creation. Sharma's journey illustrates how early experiences with data analysis projects can ignite interest in bringing analytics to journalism.

Others rediscover a latent passion for coding through unexpected circumstances, like Udemans. He began his career as a tech reporter but had extra time to take online data science courses when COVID lockdowns happened. He described that he "got bitten by the coding bug" during this period, reigniting a fascination first seeded during his China stint analyzing datasets. By converting pandemic boredom into sharpened programming skills, Udemans exemplifies those who take the longer path toward interactive journalism. He stated, "When COVID happened, I was working these sort of half hours at work. And so then I had like, I had previously done like a bunch of courses focused on data science," demonstrating how pivotal personal timing and contexts can be.

A Distinct External Motivator - Interactive Journalism as a Path to Immigration

An outlier motivational theme emerged among some international students pursuing interactive journalism careers. Unlike dominant motivations rooted in passion or creativity, practical immigration needs shaped their paths.

For example, Youyou Zhou, a Chinese international student who graduated from the University of Missouri journalism school in 2012 with a multimedia background, found visa sponsorship scarce at traditional news organizations, explaining, "It was hard for international students to find a job right after college...and like most local news firms don't sponsor visa[s]." This difficulty obtaining American work visas through mainstream journalism jobs, an issue documented in research by the Center for Immigration Studies in 2018 and American Immigration Council in 2016, identified journalism as an occupation facing labor shortages due to lack of visa sponsorship, led Zhou to pursue interactive and multimedia roles which had more accessible immigration pathways.

Similarly, Shirsho Dasgupta, who studied English in India before earning a U.S. master's degree in journalism, was drawn to interactive journalism in part for its practical visa advantages. Dasgupta needed to accumulate published works and bylines to qualify for the O-1 visa category for individuals with extraordinary achievements in their field of expertise. As he explained, "You know, if I don't have any bylines, what am I going to show for the O-1 visa requirements?" While getting bylined may not have been the initial goal, it became a necessity for Dasgupta to demonstrate his professional credentials through a portfolio of published works. The reluctance of many cash-strapped newsrooms to sponsor work visas given the costs and bureaucracy involved, an issue highlighted in the *Columbia Journalism Review* (2015), made nontraditional journalism roles more viable for international graduates seeking employment sponsorship.

While passion and creativity motivated most practitioners, some international students found that pursuing interactive journalism aligned with their aspirations while fulfilling immigration requirements, exemplifying how circumstances interplay with personal interests and goals.

Career Trajectories: Interactive Journalists Navigate Diverse Paths

As interactive journalism evolves, the career paths of those working within it offer valuable insights into the skills, experiences, and motivations that shape this ecosystem. This section examines the trajectories of interactive journalism professionals, categorizing them into early practitioners (0-4 years of prior experience), mid-career pivoters (5-9 years), and late-career pivoters (10+ years). The distinction between early practitioners (0-4 years prior experience), mid-career pivoters (5-9 years), and late-career pivoters (10+ years) highlights the diverse pathways that lead individuals to interactive journalism roles. This categorization allows us to explore how factors such as education, internship experiences, international exposure, and prior professional backgrounds influence the roles and organizations individuals pursue within this emerging field. It also sheds light on the potential for skill transfer from other disciplines like journalism, design, and engineering, which is particularly relevant for mid-career and late-career pivoters. Moreover, these categories help illuminate the varying levels of adaptability, risk-taking, and commitment to driving long-term change exhibited by professionals at different career stages. Early practitioners may be more open to frequent job transitions and international experiences, while late-career pivoters often take on leadership roles and remain in positions for extended periods, aiming to shape the direction of projects and organizations. By understanding these distinct patterns, we can better anticipate the future trajectories of interactive journalism

professionals, identify potential gaps or areas of opportunity for fostering a diverse and sustainable workforce, and elucidate the unique challenges and motivations that shape individuals' career decisions within this dynamic, multidisciplinary field. I explore their job transitions, educational backgrounds, and the roles they have held, suggesting the unique challenges and opportunities each group faces. I also explore the phenomenon of interactive journalists who teach as a side gig and the reasons behind some individuals' decisions to leave the field, often seeking roles that better align with their technical backgrounds or offer a different work environment. This analysis aims to shed light on the diverse paths leading to interactive journalism positions, the factors influencing career decisions, and the potential for skill transfer between this field and other industries. These insights illuminate the current state and future of interactive journalism as a dynamic, multidisciplinary field. Figures 2.3 and 2.4 present findings on the types of organizations and geographical locations where interactive journalists held positions.

Figure 2.3: Where Do Interactive Journalists Work - Types of Organizations

Where Do IJ Work - Types of Newsrooms?

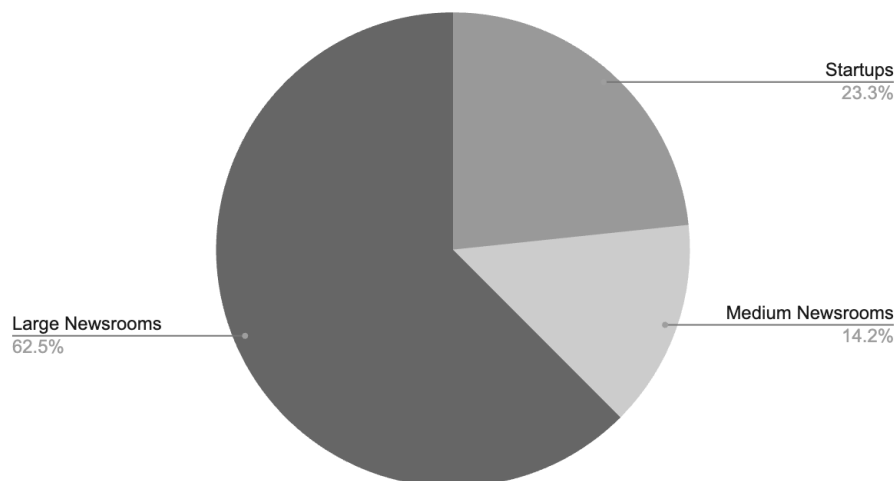


Figure 2.4: Where Do Interactive Journalists Work - Geographical Locations

Country	#Participants
US	20
Spain	3
Australia	2
India	2
Mexico	2
Netherlands	2
Singapore	2
UK	2
Lithuania	1
Brazil	1
Guatemala	1
New Zealand	1
South Africa	1
Sweden	1
Ukraine	1

Early practitioners (0-4 years experience before IJ)

Early practitioners of interactive journalism careers exhibit a proactive approach to integrating emerging technologies into journalism. They often kickstart their careers with internships or entry-level roles in a mix of legacy media organizations, medium-sized organizations, and startups. Many early practitioners seek international experiences, particularly in the United States, as seen in the trajectories of Alex Lim and Laura Aragó. Alex Lim leveraged a series of internships at The New York Times, each lasting around six months, before moving to Australia for interactive design and data visualization roles at The Stuff magazine.

Laura Aragó, from Spain, started with a 6-month data journalist internship at El Mundo, a legacy media organization in Spain, followed by a 3-month internship at Grup Nació Digital, before progressing to take on the data journalist role at La Vanguardia, a Spanish legacy media organization, where she has been working for the past seven years. Early practitioners often hold roles with titles such as data journalist, data visualization developer, and interactive designer. They tend to stay in positions for 1-5 years before moving on to new opportunities, reflecting their adaptability and willingness to learn. However, there are anomalies within this category. Nadiia Romanenko, for instance, transitioned directly into a data scientist role at a startup, Texty.org, in Kyiv, Ukraine, without any prior internships and has stayed in that position for five years. Once established in legacy media organizations, either in their home countries or abroad, early practitioners of interactive journalism tend to remain there for a significant portion of their careers. They rarely transition from these well-established companies to medium-sized organizations or startups. Instead, they typically only leave legacy media to pursue entrepreneurial ventures by founding their own startups or to contribute to the field through academic roles in research and teaching positions.

Mid-career pivoters (5-9 years experience before IJ)

Mid-career pivoters transition into interactive journalism roles after gaining substantial experience in other fields. They often work in legacy media or medium-sized organizations, leveraging their prior journalism, design, or engineering expertise to pivot into interactive roles, and vacillate between the two. This could be because they join at more senior roles such as Interactive Editor, Senior Reporter, Art Director, Visualization Editor, etc. International experience is uncommon among mid-career pivoters, with many staying in their home countries

to find different opportunities. Spanish journalist Antonio Hernández, for example, leveraged his journalism background to pivot into a frontend and data visualization developer role at Madrid-based El Confidencial, a medium-sized organization, before moving to a similar role at Civio, a startup based in Spain. Roles for mid-career pivoters often include “senior” in their titles such as data visualization developer, digital designer, and data and graphics journalist. They tend to stay in positions for 2-4 years before seeking new challenges. There are, however, some anomalies. Interactive journalists like Rahul Mukherjee started with a series of short internships (3-6 months) in the United States before transitioning into longer-term roles. Similarly, Rhiona-Jade Armont also worked multiple short stints, primarily with legacy media organizations in Australia, before her 4-year stint as a producer at Al Jazeera Media Network in Malaysia.

Late-career pivoters (10+ years experience before IJ)

Late-career pivoters bring a wealth of diverse experience to interactive journalism, often coming from backgrounds such as infographics journalism, engineering, and design. They tend to work in legacy media organizations, startups, or academic institutions, frequently in leadership roles such as Visual and Data Driven Storytelling Editor, Special Projects Editor, or Graphics Editor or Multimedia Editor, or positions that allow them to shape the direction of their projects. Many late-career pivoters are based outside the US, with some holding leadership positions at international organizations. Geoff McGhee, for instance, spent two years as an interactive chief executive at Le Monde, a legacy outlet in France, before transitioning into academic roles at Stanford, where he has been for over ten years in various capacities, including creative director and associate editor. Roles for late-career pivoters often include titles such as founder, interactive

chief executive, and creative director. They tend to stay in these positions for extended periods, often five years or more, reflecting their commitment to driving long-term change and innovation. However, there are notable anomalies within this category. David Cabo, for example, founded a startup, Civio, in Spain and has been working there for 11 years, leveraging his engineering background to drive data-driven journalism projects.

The Prevalence of Teaching Among Interactive Journalists

Teaching emerges as a significant theme among interactive journalists, as they dedicate time to sharing their expertise and real-world experiences alongside their demanding full-time roles. The practice of journalists teaching courses alongside their media work appears to be quite common, aligning with trends observed in academic literature. Many interactive journalists take on teaching roles to supplement their incomes, share professional expertise with students, explore academic interests, and benefit from more flexible schedules that teaching can provide (Ramaprasad, 2005; Voakes, 1998). This allows them to "give back" to their profession while bridging gaps between journalism theory and newsroom practices (Greenwood & Reinardy, 2011). The interdisciplinary backgrounds of the interactive journalist-educators, spanning journalism, design, computer science and engineering, reflect the diverse skill sets required in this multifaceted field. Their teaching subjects closely mirror their areas of professional specialization, ensuring students receive relevant, contemporary training from practitioners.

This trend may also stem from various other factors, including the need to supplement incomes due to the relatively low pay in interactive journalism, concerns about the precarious nature of journalism careers and the possibility of media outlets going out of business, or the potential risk of job instability and layoffs within the industry. A distinguishing feature of the

journalist-educators is their diverse backgrounds spanning journalism, design, computer science, and engineering. This interdisciplinary representation reflects the multifaceted nature of interactive journalism, requiring a blend of storytelling, visual design, and technological proficiency. Geoff McGhee, for instance, transitioned from a background in infographics journalism into interactive journalism before teaching at Stanford University for over ten years in roles such as creative director and associate editor. Similarly, Eduard Martín-Borregón, who has a journalism background, taught interactive journalism and digital media at the Universidad Carlos III de Madrid in Spain for about three years.

The journalists I interviewed have taught at various prestigious institutions. McGhee taught multimedia storytelling and data visualization at Stanford University for approximately five years while concurrently serving as the Director of Video and Multimedia at Stanford's Bill Lane Center for the American West. The subjects taught by interactive journalists align closely with their professional expertise, ensuring students receive relevant and up-to-date knowledge. Rodrigo Menegat, a data journalist, taught data journalism and computational storytelling at the Pontifical Catholic University of Rio Grande do Sul (PUCRS) and Universidade Federal do Rio Grande do Sul (UFRGS) in Brazil for around four years, while Andrew Rodriguez Calderón, who has a journalism background, taught data journalism at Columbia University.

The duration of teaching commitments varies, but many interactive journalists demonstrate a significant commitment to education alongside their primary professional roles. McGhee taught for over ten years, Menegat for around four years, suggesting an extended duration of teaching commitments is common among these professionals. This dedication highlights their passion for nurturing the next generation of practitioners.

Teaching as a side gig is less common among early practitioners, likely due to their focus on establishing their careers and gaining experience. However, some early practitioners like Calderón, who has a journalism background and entered interactive journalism in 2018 with four years of experience, taught data journalism at Columbia University while working as a data journalist at The Marshall Project. Teaching as a side gig is more common among mid-career pivoters, such as Menegat, a data journalist who entered interactive journalism in 2016 with three years of experience and taught data journalism and computational storytelling at universities in Brazil for around four years while working in the field. Teaching as a side gig is most prevalent among late-career pivoters, like McGhee, who entered interactive journalism in 1999 with three years of experience and has over 25 years of experience in interactive journalism and related fields. He taught multimedia storytelling and data visualization at Stanford University for approximately five years.

Exiting Interactive Journalism: Navigating Burnout and Career Transitions

Any study of career paths in interactive journalism would be incomplete without considering the professionals who opt to leave the field and the factors influencing their decisions to seek opportunities elsewhere. Interactive journalists leaving the field is not uncommon, with 12 out of the 42 professionals studied having departed from their roles in interactive journalism. While the reasons for these exits may be diverse, the only factor that emerged in the interviews was burnout. The high-pressure environment, constant deadlines, and uncertainty associated with the news industry can lead to a mismatch between expectations and the reality of working in this field, ultimately influencing the decision to seek opportunities elsewhere.

Manas Sharma entered interactive journalism in 2017 with no prior experience and worked as a graphics journalist at Reuters for five years before joining Defog.ai (a Y-combinator-funded AI startup) as a Product Engineer in May 2023. In his new role at Defog.ai, Sharma is responsible for creating user-friendly visual interfaces for AI agents and engineering both frontend and backend components to ensure a seamless and integrated user experience. He spoke about his decision to transition out of the newsroom:

I think it is burnout. In 2020, when we did so much work during COVID, the whole team was kind of burnt out. But this is very different from that one. Even the stuff that I thought would excite me kind of doesn't. It feels different as if I've given enough to this field of work for so long, and everything is derivative from what I've done before. There are other avenues of growth, like writing, reporting, or doing something else within the newsroom, but I don't really want to explore them right now. I just want to explore these other things outside of the newsroom. I think, personally, I was also becoming slightly cynical of the actual impact of our work. I can't really come up with ideas at the pace of the news cycle, and I don't really enjoy that pace, where I don't get time to actually consider an idea.

Sharma's experience highlights the potential challenges professionals face, particularly those with strong technical or design backgrounds, in adapting to the demands and realities of working in interactive journalism. Leaving interactive journalism is more prevalent among early practitioners with computer science, engineering, or design backgrounds, as they often seek positions more closely related to their expertise.

Several interactive journalists have left the field for roles in computer science, engineering, or other related areas. After five years in interactive journalism, Nadiia Romanenko

left her position as a Data Scientist at Texty.org, a startup abroad. She now works as an NLP Data Scientist at Loio, an NLP company, where she has been for three years. Similarly, after nine years in interactive journalism, Derek Watkins, who left his position as a Graphics Editor at The New York Times, a legacy media organization in the US, now works as a Senior Data Visualization Engineer at Netflix, where he has been for three years. These transitions suggest that the skills and knowledge acquired through interactive journalism can be highly transferable to other industries, particularly in the technology sector, where the demand for data visualization, frontend development, and user experience design is high.

The trend of seeking out computer science roles after working in interactive journalism is not limited to those with CS backgrounds. Even professionals who entered interactive journalism with journalism or other non-technical backgrounds sometimes transition to CS positions after gaining experience in the field. For example, Antonio Hernández, who has a communication undergraduate degree and a journalism master's, was a Data Visualization Journalist at Civio for six years and transitioned to become a Frontend Developer at Nalanda Global (a Spain-based software consulting company), where he has been for two years.

However, not all exits from interactive journalism are permanent. Some individuals, such as Rachael Dottle, left interactive journalism but eventually returned to the field. Dottle, who has a bachelor's degree in urban studies and sociology and entered interactive journalism in 2017 with five years of experience, moved from her role as a visual journalist at FiveThirtyEight into a data visualization designer role at tech giant IBM for a year before coming back to being a graphics journalist at Bloomberg. She said,

After working at FiveThirtyEight for a while, I got a little bit burnt out from working on a lot of politics stories. Working on election data and graphics for elections was pretty

tiring, and I was just burnt out. So, I left journalism for a year. I worked at IBM in a data science team doing similar work, but it was just for IBM clients instead of journalism, and I did not enjoy that. So I came back.

The cyclical pattern of some professionals leaving and eventually returning suggests that, despite the challenges, interactive journalism still strongly appeals to some individuals, offering unique opportunities and a sense of purpose that draws them back.

While leaving interactive journalism is less frequent among mid-career pivoters compared to early practitioners and even less common among late-career pivoters who often hold leadership positions, retention in the field remains a challenge. Yuliya Parshina-Kottas, who has a design background and entered interactive journalism in 2012 with ten years of experience, left her visual and data-driven storytelling editor role at The New York Times in 2023 after ten years. Since then, she has been teaching Visual Journalism in the Interactive Telecommunications Program (ITP) as an adjunct professor at New York University. Although the specific reasons for her departure are not known, factors such as burnout and a desire for a change of pace, an interest in sharing her expertise with the next generation of journalists, the precarity of journalism, or a need for a better work-life balance may have influenced her decision to transition into teaching. This move also underscores the versatility of the skills gained through interactive journalism and their applicability in various settings.

III. Discussion and Conclusion:

The study suggests a range of motivations driving individuals to pursue careers in interactive journalism, from inspirations sparked by pioneering work, as noted by Usher (2016),

and inherent drives towards impactful storytelling, as described by Parasie (2011), to early developmental experiences seeding interest, which resonates with Perreault's (2023) findings. However, the research also points to an additional motivation tied to immigration needs, exemplifying how practical circumstances can interplay with professional aspirations for some international students. These findings suggest that while passion and inspiration play a significant role in attracting individuals to interactive journalism, external factors such as immigration requirements can also influence career choices, particularly for those from diverse backgrounds.

The research also sheds light on the challenges and potential inequities in accessing and succeeding in interactive journalism. Bourdieu's (1984) theory of cultural capital helps explain how privilege and access can shape who acquires the necessary skills and experiences to thrive in this field. The study pointed out that internships and fellowships, which often serve as entry points, are frequently unpaid or poorly compensated, making them unfeasible for those without financial support. Perlin (2012) and Frenette (2015) have previously discussed the exclusionary nature of unpaid internships, which can perpetuate social inequalities by favoring those with the means to work for free.

Similarly, pursuing a master's degree or enrolling in multiple online courses (MOOCs) requires significant financial investment, which may be out of reach for many aspiring journalists. Wacquant (2018) argues that the increasing cost of higher education can reinforce social hierarchies, while Hartley and Wen (2015) note that MOOCs, despite their promise of accessibility, often cater to those who already possess a certain level of cultural capital. The study's findings highlight how the high cost of technology-related education, combined with the

relatively low salaries in journalism compared to other industries (Weaver & Willnat, 2012; Reinardy, 2011), can create barriers for individuals from less privileged backgrounds.

The research also highlights the phenomenon of interactive journalists engaging in teaching as a side gig, which aligns with observations by Hanusch and Tandoc (2019). This finding suggests that even those who have succeeded in the field may need to supplement their income, further underscoring the financial challenges associated with interactive journalism.

Moreover, the study examines instances of interactive journalists leaving the field for better-compensated roles that align with their technical backgrounds. This attrition has been previously discussed by Cohen (2015) and Ekdale et al. (2015), who argue that journalists often face difficult choices between their passion for the profession and the need for financial stability. The findings of this study contribute to this discussion by highlighting how the unique skill sets of interactive journalists may make them particularly susceptible to being lured away by other industries. The findings in this chapter have illuminated the multidisciplinary foundations and drive propelling professionals into the interactive journalism sphere. However, understanding their diverse entry points and motivations is just the beginning. Chapters 3 and 4 will build on these insights to provide a comprehensive picture of interactive journalism. Chapter 3 takes readers into the newsroom to closely examine the day-to-day functions, innovative practices, and collaborative workflows that define the work of interactive journalists. It sheds light on how they blend technology and journalism to create impactful multimedia stories.

CHAPTER 3: WHAT DO INTERACTIVE JOURNALISTS DO?

REDEFINING PRACTICES AND WORKFLOWS FOR A NEW ERA OF JOURNALISM

Introduction

The traditional 20th century newsroom operated like an assembly line, with clear divisions of responsibility and compartmentalized roles. Reporters and journalists handled pitching, researching, interviewing, and writing initial articles. Editors performed fact checking, reviewed for biases, edited for brevity/clarity, and selected headlines. Further down this line were graphics desks, illustrators, or cartoonists - grouped as visual “service desks” to provide supplemental elements like data visualizations, information graphics, editorial cartoons, and photojournalism. Though considered supporting roles, the imagery and visuals they created were crucial for bringing stories to life. These service desks operated as vendors to the reporting-side staff. Visual teams chose illustrations and graphics independently then passed them down the assembly line, rather than collaborating with writers. Similarly, newly created multimedia editor positions oversaw development of interactive elements like video, audio, and animations - but with little input from actual reporters covering stories. This rigid structure enabled efficient production through division of labor. However, it isolated staff in prescribed duties within their respective silos until final publication. This model faced challenges as digital media transformed reader expectations around interactivity and customization.

The integration of data journalism and interactive journalism into newsroom practices has become increasingly prevalent, with data teams evolving from niche roles to integral components of newsroom operations (Kalender, 2024). The practice of data journalism extends beyond Western-centric research and is also prevalent in Asia, where newsrooms are increasingly utilizing analytical and visualization tools for data-driven storytelling (Wu, 2022). The COVID-19 pandemic has further accelerated the adoption of data-focused journalism and explanatory stories, conditioning readers to engage with more complex events and phenomena through interactive formats (García-Avilés et al., 2024).

In the contemporary digital landscape, the field of journalism is undergoing substantive transformations, compelling the acquisition of novel skills and the assumption of diverse roles (Coddington, 2015; Usher, 2016). While the foundational tenets of traditional reporting and storytelling persist as fundamental, the emergence of interactive journalism introduces a dynamic amalgamation, incorporating elements such as data analysis, information visualization, coding, and technical development to engender innovative multimedia narratives. This interplay between tradition and evolution prompts critical inquiries into the transformative effects of interactive journalism on newsroom practices.

Scholars recognize the need to update journalism education to incorporate data literacy and interactive journalism skills into curricula (Bobkowski & Etheridge, 2023). As newsroom innovations and collaborations with external parties, such as interactive journalism startups or labs, become more commonplace (Cools et al., 2022), the identities of interactive journalists are shaped by their level of integration into legacy media organizations. Data and interactive journalists also increasingly rely on third-party collaborations and crowdsourcing techniques to

gather public data for investigations, suggesting a growing trust in independent data journalism organizations (Martin et al., 2022).

The intersection of journalism with other disciplines such as computer science and design begets the establishment of interactive teams, ushering in novel elements and workflows that introduce a sense of novelty to news organizations. Researchers have explored the rising importance of data in today's newsrooms (Coddington, 2015; Usher, 2016), but there is limited exploration of the roles within interactive teams, how they are integrated into the larger newsroom, and their ramifications for editorial processes. While extant studies recognize the ascendancy of data in investigative journalism (Houston & Horvit, 2020) and the proliferation of interactive graphics (Weber & Rall, 2012), a focused examination of emerging occupational identities and beliefs within these teams remains conspicuously limited.

This chapter aims to identify the specific roles and functions executed by interactive journalists in their daily professional engagements. The exploration focuses on the convergence of traditional and cutting-edge functions within hybrid teams, unveiling collaborative tensions and innovations that underlie their operational dynamics. The ensuing findings illuminate how interactive journalists navigate intricate workflows, amalgamating analysis, visuals, and narratives across a multifaceted skill set, encompassing reporting, coding, information design, and product development. Additionally, the inquiry delves into the delicate equilibrium between tradition, represented by the traditional routines of the newsroom and the new practices of specialized data analysis and visualizations. The strategies employed by interactive journalists, aligning their professional ambitions with the constraints inherent in exploring novel storytelling techniques, are also brought to light.

Interviews with 24 interactive journalists provide crucial insights into the evolving landscape of interactive journalism, pointing to key features that define this emerging field. Firstly, a comprehensive analysis of interactive journalism functions highlights the nuanced responsibilities and strategic beliefs that shape this profession. The chapter examines how core journalistic functions like pitching, writing, and editing are being adapted to incorporate data-driven storytelling and interactive elements. It also delves into the specialized roles that interactive journalists play in acquiring and interrogating datasets, translating insights into compelling visuals, and balancing innovation with clarity in building visualizations. Secondly, an examination of collaborative workflows uncovers how complementary abilities contribute insights across the production process, emphasizing critical handoff points and interdependencies. The chapter also suggests the importance of the collaborative workflows between interactive journalists and writers, designers, developers and others, highlighting their partnerships, iterative processes, and consultations with technical experts. Throughout, the findings showcase the diverse skills required of interactive journalists, alongside existing divisions, capturing identity beliefs that gauge the professionalizing impact of interactive journalism. This chapter argues that as journalism incorporates interactivity, tensions between tradition and innovation arise, necessitating a critical exploration of alignments and divisions within interactive journalism. By unraveling these dynamics, this analysis provides a scholarly perspective on the permeation of interactive elements and their influence on reshaping the fundamental essence of journalism.

Literature Review

Data journalism and interactive journalism have emerged as innovative practices in the field of journalism, transforming the way news stories are produced and consumed. These new formats combine traditional journalistic practices with data analysis, visualization, and interactive elements to create engaging and informative content (Appelgren & Nygren, 2014; Borges-Rey, 2016; Young, Hermida, & Fulda, 2018). Unlike traditional journalism, which primarily relies on text-based narratives and static images, data journalism and interactive journalism offer a more dynamic and immersive experience for the audience (Coddington, 2015; Hermida & Young, 2017). The availability of data journalism tools has empowered newsrooms to handle both routine tasks and more advanced data-driven reporting (de-Lima-Santos et al., 2020). The integration of data journalism with infographic and computer-assisted reporting practices has become a common practice in modern newsrooms (Chiumbu & Munoriyarwa, 2023).

In addition to new career paths and training expectations, interactive journalists have a different role in the newsroom than traditional journalists. Journalists are now expected to be programmers (Royal, 2012), especially those in hybrid roles. The ability to create online, data-driven, interactive features on a news agency's webpage is mostly a role left to the interactive journalist (Royal, 2010), even though traditional journalists are also expected to have basic knowledge about how to work with data. The interactive journalist is the expert in this domain. Moreover, the interactive journalist serves as the link between the audience and the newsroom, or rather, exists at the "meza" level of analysis proposed by Bourdieu (Benson, 2006). For example, some of the world's major newspapers, such as the Washington Post, have live online journalism and chat with subscribers (Young, 2000). This interaction, while not

visualization per se, is still a part of the interactive field and shows a new level of engagement with the public that was not possible before the internet. In fact, chat rooms and social media journalism have fundamentally changed the relationship between reader and journalist - the gap between the two has narrowed (Møller Hartley, 2013). While newsrooms have adapted existing technologies to meet the demands for data-driven coverage, structural and institutional factors have at times impeded the full integration of data journalism and editorial automation (Montaña-Niño, 2024). Nevertheless, the impact of data journalism within newsrooms has been substantial, with data teams evolving from niche roles to becoming integral components of newsroom operations, influencing other teams as well (Kalender, 2024). The practice of data journalism extends beyond Western-centric research and is also prevalent in Asia, where newsrooms are increasingly utilizing analytical and visualization tools for data-driven storytelling (Wu, 2022).

The rise of data journalism and interactive journalism has led to significant changes in newsroom practices and workflows. Journalists are now required to possess a new set of skills, including data analysis, coding, and visualization, in addition to traditional reporting and storytelling abilities (Parasie & Dagiral, 2013; Appelgren & Nygren, 2014). Conflicts arise between those journalists who possess these cutting-edge skills and those who do not. This shift has led to the emergence of new roles within newsrooms, such as data journalists, programmers, and designers, who work collaboratively to create data-driven and interactive stories (Fink & Anderson, 2015; Borges-Rey, 2016). The integration of metrics and analytics into newsroom practices has become standard, enabling news organizations to gain a better understanding of audience interactions and tailor content accordingly (Nelson & Edgerly, 2021).

The practice of data journalism involves a series of steps that differ from traditional journalism. The process begins with identifying a newsworthy story and gathering relevant data from various sources, such as government databases, public records, and social media platforms (Borges-Rey, 2016; Tabary, Provost, & Trottier, 2016). Journalists often collaborate with data specialists or use data scraping tools to collect and clean the data (Appelgren & Nygren, 2014; Young et al., 2018). This step is critical, as the quality and accuracy of the data directly impact the credibility and effectiveness of the final story (Parasie & Dagiral, 2013).

Once the data is collected, journalists analyze and interpret the information to uncover meaningful insights and patterns. This process often involves using statistical analysis tools and techniques, such as regression analysis and data mining (Coddington, 2015; Fink & Anderson, 2015). New age journalists, in this case interactive journalists, must possess a combination of traditional reporting skills and data literacy to effectively analyze and communicate the findings (Hermida & Young, 2017; Uskali & Kuutti, 2015). This step requires a deep understanding of the data and its context, as well as the ability to identify compelling stories and angles (Parasie & Dagiral, 2013). Data visualization is a crucial component of data journalism, as it helps to make complex information more accessible and engaging for the audience. Journalists collaborate with designers and developers to create charts, graphs, maps, and interactive elements that effectively convey the story (Stalph, 2018; Young et al., 2018). The visualization process involves selecting the most appropriate visual format, designing the layout and user experience, and ensuring that the final product is both informative and visually appealing (Cairo, 2012; Weber & Rall, 2012).

The publication and dissemination of data journalism and interactive journalism projects often require a different approach compared to traditional journalism. The projects may be published on dedicated web pages or platforms, allowing for greater interactivity and exploration

(Appelgren & Nygren, 2014; Hultén & Edwardsson, 2018). Journalists also use social media and other digital channels to promote the projects and engage with the audience (Borges-Rey, 2016; Hermida, 2013). This shift has led to the emergence of new roles within newsrooms, such as data journalists, programmers, and designers, who work collaboratively to create data-driven and interactive stories (Fink & Anderson, 2015; Borges-Rey, 2016).

Collaboration is a key aspect of data journalism and interactive journalism, as these formats often require the expertise of professionals with diverse skill sets (Appelgren & Nygren, 2014; Borges-Rey, 2016). Data journalists, who possess strong data analysis and storytelling skills, work closely with programmers and designers to create compelling and informative stories (Fink & Anderson, 2015; Parasie & Dagiral, 2013). This collaborative process involves a continuous exchange of ideas, knowledge, and feedback among team members (De Maeyer et al., 2018; Tabary et al., 2016).

The collaboration between journalists and programmers is particularly crucial, as it enables the creation of sophisticated data analysis and visualization tools (Parasie & Dagiral, 2013; Young et al., 2018). Programmers help to automate data collection and cleaning processes, develop custom software for data analysis, and create interactive visualizations that enhance the storytelling (Fink & Anderson, 2015; Tabary et al., 2016). Data journalists, in turn, provide the journalistic expertise needed to identify compelling stories, interpret the data, and communicate the findings effectively to the audience (De Maeyer et al., 2018; Parasie & Dagiral, 2013). Designers also play a vital role in the collaborative process of data journalism and interactive journalism. They work closely with data journalists and programmers to create visually appealing and user-friendly interfaces that facilitate the exploration and understanding of complex data (Hullman & Diakopoulos, 2011; Cairo, 2012). Designers help to ensure that the

final product is both informative and engaging, using techniques such as data visualization, infographics, and interactive elements (Weber & Rall, 2012; Young et al., 2018).

The collaborative nature of data journalism and interactive journalism has led to the development of new workflows and project management practices within newsrooms (Boyles & Meyer, 2016; Fink & Anderson, 2015). Teams often adopt agile and iterative approaches, which allow for continuous feedback and refinement throughout the project lifecycle (Boyles & Meyer, 2016; Tabary et al., 2016). This collaborative and iterative process enables teams to adapt to changing circumstances, incorporate new insights, and deliver high-quality stories that meet the needs of the audience (De Maeyer et al., 2018; Young et al., 2018).

However, the collaboration between data journalists, programmers, and designers is not without challenges. Differences in professional backgrounds, work practices, and communication styles can lead to tensions and misunderstandings among team members (Boyles & Meyer, 2016; Fink & Anderson, 2015). To address these challenges, newsrooms need to foster a culture of collaboration, provide training and support for interdisciplinary work, and establish clear roles and responsibilities within the team (Appelgren & Nygren, 2014; De Maeyer et al., 2018).

The integration of data journalism and interactive journalism into newsrooms has not been without challenges. Newsrooms often face resource constraints, such as limited budgets, time, and personnel, which can hinder the production of data-driven and interactive stories (Fink & Anderson, 2015; Borges-Rey, 2016). Additionally, there can be cultural and organizational barriers, such as resistance to change and a lack of understanding of the value of data journalism among traditional journalists and editors (Appelgren & Nygren, 2014; Uskali & Kuutti, 2015).

Despite these challenges, the practice of data journalism and interactive journalism continues to grow and evolve. Newsrooms are increasingly recognizing the value of these new

formats in engaging audiences and providing in-depth, data-driven reporting (Loosen, Reimer, & De Silva-Schmidt, 2020; Stalph & Borges-Rey, 2018). As a result, many newsrooms are investing in training and resources to support the development of data journalism and interactive journalism skills among their staff (Fink & Anderson, 2015; Hermida & Young, 2017).

Findings

Newsroom Functions

The interviews with data journalists provide an in-depth look at the evolving newsroom functions and workflows within the field of interactive journalism. The findings present how this field blends core journalistic functions from traditional reporting and editing with new specialized roles tailored to data analysis and interactive presentation. The interviews demonstrate how data journalists are adapting traditional journalistic functions like pitching, writing, and editing for interactive storytelling.

Interviews also highlight specialized roles related to working with data in the journalism context. For example, data analysis involves acquiring, interrogating, and deriving insights from datasets. Visual designers determine how to best communicate findings through graphics tailored to the audience and story goals. Developers collaborate to make visualizations dynamic and interactive. Throughout the workflow, the close cross-functional partnership between these complementary skills enables the production of interactive stories, synthesizing data, visuals, interactivity, and narratives.

These findings, detailed below, provide insights into work practices and flows, and some of the challenges that emerge as interactive journalism evolves.

Core Journalistic Functions

Data and interactive journalism builds upon many of the core functions of traditional journalism, including pitching stories, writing articles, and editing content. However, these functions are adapted and expanded to incorporate the unique elements of data-driven and interactive storytelling. The interviews with data journalists shed light on how these core journalistic functions are evolving: Pitching now involves identifying compelling data-driven angles and envisioning innovative formats for users to engage with the story. Writing requires weaving together narrative, data insights, and opportunities for interactivity. Editing has expanded to include rigorous fact-checking of data analysis and refinement of visual representations to ensure accuracy and clarity. The following sections explore each of these core functions - pitching, writing, and editing - in detail and how they are being reshaped as data and interactive journalism continues to evolve.

1. Pitching Data-Driven Stories

The pitching process is a vital part of interactive journalists pursuing potential data stories. Pitching starts with the journalist identifying a worthwhile angle, frequently prompted by intriguing data they uncover. Shirsho Dasgupta, a data reporter at the Miami Herald, stated, "If a source says something like, oh, you should check XYZ out, then I can look for that number and see where that goes." Some teams also crowdsource ideas from the public to gather additional perspectives and inputs. Ellis Simani from ProPublica explained, "We will do callouts to folks to, like, have them write in with things they think we should be looking into." This allows them to source potential angles and data outside the newsroom while still evaluating viability themselves.

The data and interactive journalism pitching process builds upon the traditional journalism approach but places a greater emphasis on the potential for data-driven storytelling and user engagement. In traditional journalism, pitches typically focus on the narrative and sources, whereas data journalism pitches highlight the unique insights and visualizations that can be derived from datasets. Interactive journalism takes this a step further by proposing innovative ways for audiences to explore and personalize the story. Both data and interactive journalism require journalists to have a strong grasp of data analysis and visualization tools, but the fundamental principles of pitching, such as identifying a compelling angle and target audience, remain consistent across all forms of journalism.

Once a potential angle is identified, the interactive journalist considers how to source the necessary data and conduct the analysis to explore it. They also envision potential visual representations and story formats. Alex Lim, a visual journalist from The Straits Times, explained, "I go kind of visuals first because I picture what the story will look like." The timeline influences the pitching process. While mockups can demonstrate feasibility for investigative pieces, quick turnaround breaking news requires pitching a concept quickly. Manas Sharma, a data journalist, described, "For the lightning piece, we were sitting on the data for a while, but we didn't know what it would look like. So, I made the animation. And then it was a pitch because I've made this amazing, based on the lightning data animation."

Though interactive journalists drive the pitching process through data exploration and visualization, editors at their publication typically have the final say over which pitches get approved and published. Chris Udemans, a visual journalist from The Straits Times, explained, "We have this process where there is a call for pitches every few months. Otherwise, there is a system where we submit a pitch, and then with all of those pitches, we kind of vote as a team on

which pitches we think are the most interesting." However, senior editors outside the team have ultimate authority over greenlighting stories. This oversight ensures that pitches meet standards and align with organizational priorities.

Once a pitch is approved, the interactive journalist moves on to the crucial writing stage, where they transform the data-driven story concept into a compelling narrative that engages the audience. As the next chapter will illustrate, these differing perspectives between interactive journalists and traditional reporters can lead to significant collaboration challenges within newsrooms.

2. Crafting Interactive Narratives

From fully owning the storytelling process to collaborating with experienced reporters, interactive journalists employ a diverse range of writing strategies to craft compelling data-driven narratives.

At larger news organizations, some interactive journalists fully own the storytelling process, from reporting to writing to visualization. Rebecca Pazos, a data visualization editor at The Straits Times, explained that the new generation of interactive journalists is eager to engage in journalistic writing beyond their core skills. As Pazos described, "As the younger generation comes through, they are more capable, skilled, and hungry to get their hands dirty with writing and reporting. So, we definitely encourage the team to gain cross-training through knowledge sharing, whether they have a background in visualization, coding, or databases. Trying their hand at design, code, or storytelling allows an interactive journalist to expand their skill set. This mix of skills helps team members collaborate better by understanding each other's languages."

However, creating data stories in many settings involves collaboration between visualizers, coders, and print reporters. Interactive journalists like Manas Sharma, a data journalist at Reuters, share materials like interviews for reporters to draft the main text while they focus on data analysis and coding. Sharma described focusing more on data analysis and coding while experienced reporters write the text: "I think Simon just has a lot of experience...his thought process of figuring out a story is really great. So he can write very well." In these cases, interactive journalists provide the raw materials like interviews to inform the writing, as Sharma stated: "I did not write it, but I, but I had a bunch of interviews, so I transferred them."

Relying on experienced writers allows interactive journalists to maximize their analysis and coding strengths. However, frustrations emerged when partnered writing seemed subpar or print reporters were unwilling to edit their text to account for visualizations. Edit Gyenge, a freelance interactive journalist, describes this difficulty with journalists: "They just love their texts and are not willing to cut through the text. So it's kind of difficult to work because, in this case, data visualization will always be just the part, you know, that type of accessory." This tension leads interactive journalists like Gyenge to decide to fully own the writing themselves to maintain creative control and ensure the visualization and text work together. Similarly, Alex Lim, a visual journalist from The Straits Times, emphasizes the importance of high standards when his name is attached to a project: "if my name is on something...I have very high standards for it...it has to be good." Establishing collaborative norms helps avoid issues when writers and visualizers partner. Collaborating across specialties helps interactive journalists tackle the challenges of these intersecting roles, a theme the next chapter discusses.

While writing their first full news story may initially seem intimidating, many interactive journalists find they can rise to the challenge. Sharma recalled feeling nervous when writing his

first piece on the Tonga volcanic eruption and tsunami in January 2022. Though experienced with data analysis and visualization, drafting an entire news narrative from scratch posed a daunting task, as Sharma described: "Tonga was the first time that I actually wrote, okay. And when you haven't done something ever, it's obviously slightly nerve-racking."

Nevertheless, Sharma pushed through the initial trepidation, focusing on crafting a robust 1,300-1,400-word explainer article on the scientific mechanisms behind the natural disaster. Though writing initially felt outside his comfort zone, Sharma realized he could power through any doubts once he started trying. He reflected, "I wouldn't say I'm a good writer. I'm just relaxed about the fact that I can look at a blank page and try it." The Tonga story marked a milestone for Sharma. Through perseverance, he gained confidence in his ability to synthesize complex information and shape it into a compelling narrative. Sharma concentrates less on mechanics and more on communicating meaning to readers when writing news stories. He stated:

"I used to be really into the code part. And the engineering part, like figuring out this earlier complex visualization part. Now it has kind of shifted towards, like, I am more interested in how should I put this? What used to be like, Okay, how are we going to build this and how it will look versus what it will say? And, like, how to say this and what we are trying to say used to come second for me because I was so interested in the code part. Now, it is inverted, where I am more interested in, like, okay, what are we trying to say, and not so worried about, like, what tool we are going to use and like, what the code is going to look like, even though I enjoy that part as much still. But simply because I've done it so much. And I have had so much practice, I don't need to, like, you know, worry about it."

This shift from technical execution to narrative clarification signifies professional growth. While improving writing skills remains an ongoing endeavor, pushing past self-doubt allows interactive journalists like Sharma to expand their multimedia storytelling potential. What once seemed intimidating can become an exciting opportunity through persistence.

Some interactive journalists want to build their skills through practice rather than rely on aids. Even those with literature degrees find journalistic writing difficult initially. Shirsho Dasgupta, a data reporter at the Miami Herald, explained, "Getting a degree in literature doesn't make you a good writer because you're not learning how to write" journalistically. Though trained in analyzing literature, the journalistic style still requires focused practice. Despite having an undergraduate degree and a master's in literature, Dasgupta wants to strengthen his journalistic writing skills through workshops and possibly some online courses. Investing time in building writing capabilities can help interactive journalists take more ownership of crafting the narrative. While writing represents a crucial skill for interactive journalists to develop, effectively editing and refining stories also emerges as an essential competency.

Some newsrooms use design-structured templates for placing text within predefined sections to aid writing. At The Straits Times, reporters are provided writing templates using Google Docs integrated with ArchieML. Christopher Udemans, a visual journalist from The Straits Times, explained: "Basically it takes the text from a Google Doc and converts it to JSON...you would write the name of the component there. And then you would go off and code the components." ArchieML allows writers to plug text into components in a specified order. Udemans noted the importance of having a single centralized document for version control. His team also provides video tutorials to demonstrate these writing systems to reporters less familiar with interactive workflows: "We just have to, like, have a sort of a very simple tutorial on how to

use this system." These scaffolds provide inexperienced writers with a formula to follow. The varied writing experiences highlighted here likely stem from the diverse backgrounds and skill sets of interactive journalists, as Chapter 2 explored.

3. Editing for Accuracy and Visualization

Interviews with data journalists provide an inside look at the multilayered editing processes that shape interactive newsrooms. These accounts suggest how editing enables crucial verification steps, ensuring analytical rigor within data investigations. Peer editing between colleagues is a common practice for verifying analysis. Ellis Simani, a data reporter at ProPublica, explained, "I'll send a file to my colleague with the raw data sheet, draft story sentences, and a step-by-step explanation of how I conducted the analysis to get the answers. He will then thoroughly recreate the entire analysis from scratch in different software like R instead of my original Python analysis to validate that the findings are accurate and reproducible before publication."

This exhaustive "bulletproofing" peer review borrows practices from academia to guarantee reproducibility before publication. The meticulous process points to editing's role as a rigorous checkpoint. Simani and his colleague Agnel Philip described working closely together on this editing. Simani said, "We go through each other's data analysis line by line to bulletproof it. I'll do the initial analysis in Python, then Philip reproduces it in R to confirm accuracy." This level of scrutiny is unique to interactive editing.

At the same time, there is an ecosystem of oversight on different story elements. Philip said, "When conceptualizing data visualizations for a story, we'll have in-depth talks with our specialized graphics editors to first create a list of potential graphics angles and then collaboratively choose what specific visualizations would make the most sense to tell that story

best." While Philip builds basic charts himself, custom visuals go to those editors for refinement based on standards. Youyou Zhou, a data visualization editor at Vox Media, stated, "As data visualization editor, I handle the final vetting of all graphics" - a specialized role unlike traditional editing. While traditional editing focuses on text narratives and messaging, data visualization editing requires specialized skills in infographic software, visualization best practices, and translating complex data into clear graphical formats for readers.

However, tensions can arise. Christopher Udemans, a visual journalist from The Straits Times, shared, "There have been concerning instances where our editors request that we significantly water down the reporting within a hard-hitting investigative piece based on financial data to make it less critical or controversial just to avoid potential government disapproval or regulatory pushback." While providing improvements, editors may push back on controversial data stories, neutering impactful journalism to avoid ruffling feathers.

Rebecca Pazos, a data editor at The Straits Times, noted that her digital editor acts as a gatekeeper on publishing decisions. She said, "The digital editor has the final say and makes the ultimate call on which specific story ideas and graphics proposed by our team will actually move forward for publication versus those that will be shelved," acknowledging this centralized gatekeeping role is not typical at other organizations. Pazos commented, "It is a little unusual compared to how other places operate." The interviews spotlight both the collaborative potential and creative growing pains within interactive journalism's evolving editing culture. It will be discussed in detail in the next chapter.

Specialized Work

Interactive data journalism involves a specialized workflow and collaboration between journalists, data analysts, and visualization experts. The process begins with obtaining data through methods like scraping and freedom of information requests. Journalists then interrogate the data, formulating hypotheses and research questions to guide the analysis. Finally, the insights are communicated through a combination of narrative text, visualizations, and interactive graphics tailored to the story. The following sections will examine each of these stages in detail.

4. Acquiring and Interrogating Datasets

Interactive journalism begins with obtaining or "scraping" the data. Luiz Toledo, a freelance journalist, described how he regularly files FOIA requests and scrapes messy government databases in Brazil. However, he cautioned that "you cannot just trust the information"—it is essential to interview the people who built the databases to understand inherent limitations. For instance, when Toledo encountered murder statistics that seemed suspiciously low for a large city, he contacted the database creator, who explained missing data issues. Manas Sharma, a data journalist at Reuters, also discussed the need to scrape data as a journalist from sources like NASA and California's wildfire agency. Nevertheless, his team collaborates with academic researchers for complex geospatial analysis to avoid needing "a PhD for it."

Once data is in hand, the next phase involves formulating hypotheses and questions to interrogate the data. Agnel Philip, a data reporter at ProPublica, emphasized the importance of "hypothesis construction" by "working backward" from research questions to assess whether the data can answer them sufficiently. Philip stated, "I think the thing that I like is I come back to the

hypothesis construction of all of this, like, what is the question that you are trying to ask like, or what is the answer you're trying to see? And kind of working backward from there for like, what is the data that we have?" If not, the questions themselves may need adjustment. Sondre Solstad, a data journalist at The Economist, described how every data story at The Economist starts with a specific "thesis" to guide analysis, noting "So we have like, you know, beneath the title, there's the thesis of the piece." For example, when examining protests in Iran, his guiding questions focused on how widespread and sustained they were.

The hypothesis can evolve through conversations with visualizers about the best way to present the findings. As Rahul Mukherjee, a data journalist at Axios, explained, it involves investigating how the data was collected, asking creators about limitations, and querying attributes like time period covered: "How long has this been collected? What are the attributes of it? Where are the opportunities and limitations of it?" Weihua Li, a data journalist at The Marshall Project, described needing to "interview a dataset as if I were to interview a person" through statistical modeling tailored to the research questions. While journalists take the lead on analyzing more straightforward data, researcher collaborations are essential for complex data like geospatial analysis, added Sharma. This in-depth interrogation allows journalists to become near "masters of the whole world" on a topic, as Toledo described regarding his multi-month investigations in Brazil.

Finally, communicating data-driven insights requires weaving analysis into narrative text, visuals, and graphics. Ellis Simani, a data reporter at ProPublica, advised against viewing data as "magical" but using it to support broader stories. As Alex Lim, a visual journalist from The Straits Times, explained, he contributes to the "structuring and shaping the story and the narrative" through interactive visuals created "where text alone does not convey the full story."

To determine mediums, Mukherjee suggested journalists write out key points first, then decide if a visual communicates it better. At The Economist, Solstad explained that extensive back-and-forth between journalist and visualizer results in graphics that ideally reinforce the central thesis, noting, "My expertise is not. It is not making the best data visualizations possible. My expertise is supplying the insight for the sort of data that we represent." This collaboration to translate analysis into digestible insights is at the heart of impactful data and interactive journalism.

5. Translating Data into Interactive Visuals

Traditional journalists collaborate with interactive journalists to identify the most precise presentation of complex data when building visualizations. They storyboard key elements like imagery and pull quotes to control narrative pacing. For example, Alex Lim, a visual journalist from The Straits Times, thinks about visual storyboarding, like page layout, considering elements like the sizing and placement of images to control the pacing as readers scroll through. As Lim states, he also selects "key pull quotes to break up long blocks of text, directing attention to compelling passages."

Journalists carefully tailor visualizations to match each story's scope, tone, and goals. They focus on conveying the most relevant insights rather than overwhelming readers with extraneous data. Particular care is given to introductory visuals and text where reader drop-off rates are highest. Rebecca Pazos, a data editor at The Straits Times, focuses on story beginnings, spending significant time on initial visuals and paragraphs, stating, "Analytics show many readers drop off quickly." Further down in the story, she rewards the audience who stays engaged by providing additional charts and details, giving more information for those interested in

learning more. This allows her to hook readers up front while catering to those who want to dive deeper into the data.

For in-depth investigative pieces, straightforward charts and minimal interactivity directly communicate the analysis. For example, Weihua Li, a data journalist at The Marshall Project, sticks to basic charts with minimal interactivity for data-heavy investigative stories because the writing concisely explains the analysis. Li explains, "When I do a story now, I can easily do a story with seven charts, eight charts. And then that gives our developers a heart attack. Because each one is embedded as an iframe and it is responsive individually. So if you have seven charts, just like simply resizing the window, I might crash someone's browser. That's something that I didn't think about..." The graphics match the straightforward approach. In contrast, more elaborate interactives suit stories relying heavily on exploring extensive datasets.

For some visualization-heavy stories, there is room for creativity in picking visualizations and non-traditional story forms. Rachael Dottle, a data journalist, worked on a New York Times piece about the fashion industry, and as she explains, "I made collages out of magazine clippings and scanned them in and kind of gave it this like handmade zine feel." The scanned collages fit the creative subject. In contrast, Dottle felt photos would not be appropriate for an investigative story on child abuse, so she used custom illustrations and silhouettes. She states, "I didn't think stock photos would be appropriate. So I actually illustrated all of the graphics for that story." The visuals set an understated tone aligning with the sensitive reporting.

Interactive elements engage readers while guiding them to the main takeaways. Regarding an award-winning New York Times piece on subway delays that combined text, graphics, and animations, Manas Sharma, a data journalist at Reuters, describes his experience reading it: "I didn't have to switch to a different side of my brain to understand a graphic. It was

just flowing...I don't remember switching, I remember just reading and flowing through the story. It was amazing." The words, graphics, and animations flowed together without disjointed switching between mediums. It remained engaging without losing direction.

The choice of interactivity levels also depends on the story and available resources. Agnel Philip, a data reporter at ProPublica, states: "We test out how much interactivity we want to include and then choose based on feedback. I'll mock up something basic, and we'll get feedback from users on things like 'Was this hard to use?' or 'Did you understand what was happening?' And iterate from there." His team takes an iterative approach to designing interactives, testing different features and engagement based on user input during development. For example, fundamental interactions like filtering by crime type or neighborhood may suffice without an elaborate custom graphic for a short piece on crime statistics. Dottle notes: "I also think so much of it depends on what your developers have capacity for, how much time they have. Because I could be like, oh, this crazy, fancy, interactive thing is cool, but if we don't have the capacity, then that's not what we're going to make." The goal is crafting proportional interactivity tailored to the story that enhances understanding without overcomplicating.

Compelling interactivity is not just important for novelty's sake, it serves to aid comprehension and exploration of data. Adrian Blanco, a data reporter at The Washington Post, explains his team's approach: "We try to think of ways data can be explored that would not be possible in print. But also think about when a simple chart may be more effective, even online. So we're not just making things interactive for the sake of it. We want to make sure it's enhancing the storytelling." For example, Blanco notes interactivity can help readers customize COVID data views based on their specific county on a news application. However, for concise conclusions from political polling analysis, static graphics directly showcase key insights without

unnecessary interactivity. Blanco suggests including guide elements like scrolling or highlights in interactives to intentionally lead readers to significant takeaways, such as highlighting certain regions on a map.

Technical skills are used to enhance the story and not just build visuals. Even with extensive data, the purpose of interactivity is to condense findings into digestible charts and guide readers. As Luiz Toledo, a freelance data journalist, argues, "You don't need interactivity in all projects. Sometimes it's just a waste of time...the reader won't be more interested just because it's interactive." Visuals should educate without overwhelming, considering mobile readability. Ferran Morales, an Infographics Developer for Mundo Deportivo in Spain, tries innovative formats to engage readers but avoids complexity, believing compelling graphics educate without overwhelming. Morales states, "Finding the balance means considering nuance and clarity."

Experts play a crucial role in helping journalists strike the right balance between complexity and clarity. For example, Aendra Rininsland, a Senior Data Journalism Engineer at Financial Times, gives the example of reporters proposing elaborate interactive graphics to increase engagement. Rininsland explains, "Reporters will be like, oh, we should do this fancy thing. And I'm like, I don't think that fancy thing is going to achieve the goal that you want." She convinces them simpler static visuals often better achieve their goals rather than building complex custom interactives. Rininsland states, "Sometimes I have to rein in the complexity and be like, I think this can just be a bar chart. We don't need it to be interactive." Her technical knowledge helps simplify unnecessary visual complexity and focus on clarity.

Journalists balance innovation with clarity when designing visuals, focusing on interactivity and customization around the most significant insights. As Li explains, "I incorporate feedback from developers on feasibility and user experience when proposing

interactives." She gathers input on pragmatic factors like workload, responsiveness issues, and usage data to shape interactives. The ultimate goal is to use an appropriate visual approach tailored to enable reader understanding and comprehension of critical data points.

Discussion And Conclusion

The emergence of interactive journalism has brought both continuity and disruption to newsrooms. Like the work of Coddington (2015) and Usher (2016), my findings suggest that while core journalistic functions endure, novel specialized roles are transforming storytelling by integrating data analysis, visuals, and interactivity. As programming roles become increasingly common in newsrooms globally, questions emerge about how these new actors assimilate with and transform journalistic functions as the field professionalizes.

The COVID-19 pandemic has significantly changed newsroom practices and conditioned readers to more data-focused journalism and explanatory stories, laying the foundation for better engagement and acceptance of interactive journalism as essential for understanding complex events and phenomena (García-Avilés et al., 2024). In countries with slightly more mature data and interactive journalism practices than emerging regions, these formats are used for breaking news and local stories while simplifying data and interactive visualizations for less data-literate audiences (Wu, 2022).

Existing literature, especially about data journalism, spotlights a range of journalistic functions and jobs that data journalists perform in the newsroom, including data gathering, analysis, and presentation steps to make the final product (Weber & Rall, 2012). While these insights are valuable and partially replicated in my findings, my research goes beyond their work by examining how these collaborations function at a granular level, addressing a gap in the

existing literature. The spectrum of approaches to interactive journalism discussed in this chapter, from collaborative efforts between journalists and specialists to journalists taking on multiple roles themselves, aligns with the work of Hermida and Young (2019), who discussed the evolving nature of journalistic roles and the blurring of boundaries between traditional reporting and new forms of storytelling. However, my findings extend their work by highlighting the increasing ability of journalists to take ownership of the entire interactive storytelling process as they acquire skills in data analysis, visualization, and coding, challenging the notion of strict role divisions within the newsroom.

Like the findings of Lewis and Usher (2014), my research underscores the importance of collaboration and communication between journalists and specialists in producing the most effective interactive stories. These studies emphasize the significance of fostering a culture of collaboration and cross-disciplinary learning in newsrooms, which is crucial for producing high-quality interactive journalism. The rise of interactive journalism also raises important questions about the changing nature of journalistic authority and expertise, as discussed by Carlson (2015). My findings support and extend Carlson's argument, as well as the work of Lewis and Westlund (2015), by suggesting that journalists must navigate a new landscape in which their authority is derived not only from their ability to gather and report information but also from their capacity to analyze and present data in compelling ways. This shift requires journalists to develop new skills and ways of thinking about their role in the newsroom and society at large.

Newsroom innovations, hybridity of teams, and collaborations with external parties are at a high, suggesting a growing trust in the data and interactive journalism community (Cools et al., 2022). The identities of interactive journalists depend on how integrated they are into a legacy

media organization, with members of more embedded labs seeing themselves as journalists or "advanced journalists," while those in less integrated labs consider themselves service providers, engineers, or data scientists. Data and interactive journalists also increasingly use third-party collaborations and crowdsourcing techniques to gather public data for investigations, indicating an increase in trust in independent data journalism organizations (Martin et al., 2022).

Furthermore, the integration of interactive journalism into newsrooms has implications for journalistic ethics and transparency, as highlighted by Homayouni et al. (2021). My findings align with their work, suggesting that journalists must be transparent about their methods and data sources to gain and maintain credibility within the newsroom and outside with their audiences, which requires a new level of technical literacy among journalists and a commitment to explaining complex data analysis and visualization techniques in accessible ways (Coddington, 2015). By providing a detailed examination of the roles, skills, and collaborative dynamics within interactive journalism teams, this research offers a more nuanced understanding of how this emerging field is transforming newsroom structures and practices, building upon the work of Borges-Rey (2021).

Hybridity within the newsroom or external collaborations may be the way newsrooms can succeed in newer, technology-heavy formats like interactive journalism (de-Lima-Santos, 2022). Scholarship suggests that it often takes just one traditional journalist who engages in interdisciplinary collaboration with interactive journalists within or outside the newsroom to create a "domino effect" on the level to which a newsroom incorporates interactive stories and the overall practice of journalism in that newsroom (Heft & Baack, 2022). The findings in this chapter lay the groundwork for future research on the evolving roles and practices of interactive journalists within the newsroom. Building on the insights provided by the interviewed

professionals, scholars could delve deeper into the day-to-day workflows and challenges faced by interactive journalists as they navigate the intersection of traditional reporting, data analysis, and visualization, as suggested by Hermida and Young (2019). Future studies could also examine how the integration of interactive journalism is reshaping newsroom structures, hierarchies, and decision-making processes, as well as the implications of these changes for the production and dissemination of news content, extending the work of Borges-Rey (2021). Additionally, researchers could explore the training and professional development needs of interactive journalists, identifying the key skills and competencies required to excel in this emerging field and the most effective strategies for acquiring them, as proposed by d'Haenens et al. (2022). By pursuing these lines of inquiry, scholars can contribute to a more comprehensive understanding of the roles and functions of interactive journalists and the broader impact of interactive journalism on the future of the news industry.

Another area for future research is the impact of interactive journalism on journalism education and training. As the skills and competencies required for interactive storytelling continue to evolve, journalism schools and professional development programs will need to adapt their curricula and teaching methods to prepare students and practitioners for the challenges and opportunities of this emerging field (Anderson et al, 2017; Bobkowski & Etheridge, 2023). Researchers could explore the effectiveness of different pedagogical approaches, as well as the role of industry partnerships and experiential learning opportunities in fostering the development of interactive journalism skills, building upon the work of Merrymen (2019).

Ultimately, the emergence of interactive journalism represents both an opportunity and a challenge for newsrooms. By embracing new technologies, skills, and collaborative approaches,

journalists can create powerful and engaging stories that inform and empower their audiences. However, this transformation also requires a willingness to rethink traditional roles, workflows, and ethical frameworks, as argued by Zamith and Braun (2019). As newsrooms continue to navigate this shifting landscape, it will be crucial for journalists, specialists, and newsroom leaders to work together to develop a shared vision for the future of interactive journalism and its role in serving the public interest. Through ongoing research and experimentation, scholars and practitioners can contribute to the development of a more robust and socially responsible model of interactive journalism that leverages the power of data and technology to enhance public understanding and engagement with the news. While this chapter outlined the evolving practices of interactive journalism, Chapter 4 turns a lens on the obstacles interactive journalists encounter as they navigate ingrained newsroom cultures. It suggests the tensions that can arise when emerging interactive roles intersect with traditional journalism hierarchies and mindsets.

CHAPTER 4 - NEWSROOM INTEGRATION CHALLENGES AND HOW INTERACTIVE JOURNALISTS NAVIGATE THEM

Introduction

During my time working for a financial newspaper in India between 2013 and 2016, I noticed a stark divide between the traditional newsroom staff and the data journalism team. In one area of the newsroom, reporters and editors work diligently on writing and editing the day's news articles, making calls to sources, and shuffling through papers to prepare their stories for publication on tight deadlines. The familiar sounds of the bustling newsroom filled the air - ringing phones, steady deadline pressure simmering beneath surface banter, and the occasional exasperated sigh from a frustrated reporter wrestling with a story. Meanwhile, in another corner, a team of data journalists sit focused on their computer screens filled with striking data visualizations and intricate charts made with programs like Tableau, R, and Python. Their headphones block out the ambient noise as they work intently with data to support the newsroom's reporting. These interactive journalists handle the technically complex work of data analysis, visualization, and digital storytelling, which increasingly powers modern investigative revelations. They are computer science and data engineering experts - fields that have taken the world by storm with competitive programs, high pay, and enormous prestige. Despite being respected outside newsrooms for their mathematical minds and "geeky" technical prowess, these data specialists do not enjoy that same solid standing with their journalism-school-educated counterparts inside many media institutions. Instead, they often struggle behind the scenes to

receive recognition and respect among editors and reporters occupying newsrooms' central seats of influence.

Interviews conducted with 24 interactive journalists shed light on the challenges they face in their roles, which often involve working with data, creating graphics, developing visualizations, and coding. These professionals frequently report feelings of being undervalued, overlooked, or misunderstood within their organizations. Their experiences suggest that the specialized skills and contributions of interactive journalists are not always fully recognized or appreciated by their colleagues and management, leading to a sense of marginalization within the newsroom. Interactive journalists face unique challenges in the contemporary newsroom, despite the growing demand for their specialized skills in data analysis, visualization, and coding. Two significant issues emerge: first, a pervasive "service-desk" mentality that positions interactive journalists as mere support staff rather than integral members of the reporting team. This mindset is exacerbated by the absence of a standardized system for attributing bylines to their work, further contributing to their marginalization.

The execution of interactive projects is often hindered by confusion and lack of understanding stemming from the contrasting professional backgrounds of traditional journalists and developers. Journalists, rooted in the world of reporting and storytelling, may struggle to grasp the technical intricacies of coding and data analysis. Conversely, developers, well-versed in programming and software development, may find the nuances of journalistic practices and source cultivation foreign. These disparate skill sets and perspectives can lead to communication breakdowns and inefficiencies when planning and implementing interactive projects, as team members grapple with navigating unfamiliar territory and bridging the gap between their respective expertise.

The established editorial attitudes often relegate interactive journalists to a supplementary "service desk" role of executing others' ideas rather than directing key editorial or data analysis strategies. Ellis Simani, an accomplished investigative data journalist, recounts experiences of marginalization within the newsroom hierarchy. Despite excelling in his role and delivering high-quality work, Simani reports feeling like a "second-class citizen" among his colleagues. He describes instances where his editorial input is disregarded, as print journalists assert their dominance over the direction of the story while simultaneously relying on his technical expertise to bring their vision to life. This dynamic creates a paradoxical situation in which Simani's skills are in high demand, yet his contributions are undervalued and his voice is silenced in the decision-making process. The experience of excelling in one's field while being treated as subordinate highlights the deeply ingrained power structures and professional barriers that continue to hinder the full integration and recognition of interactive journalists within traditional newsrooms. Confined to presenting material that pushes preconceived narratives, true equality requires recognizing interactive specialties as increasingly central, not optional. Digitally hesitant newsrooms, entrenched in traditionalist hierarchies, face imminent and unavoidable power shifts that they are reluctant to embrace.

Also, as an aspect of the "service desk" mentality, interactive journalists often do not receive printed bylines or attribution for their work on stories. This lack of recognition for their work hinders advancement opportunities and prevents them from gaining the respect of traditional journalists. There is confusion due to inconsistent policies around whether interactive journalists can provide tangible proof of their work, which print veterans depend on for career advancement. As data journalist Agnel Philip explains, when there is no byline "they cannot

fully understand my actual contribution." Without transparent credit for central analysis powering exposés, their work can wrongly seem delegated, not integral.

When journalists and developers collaborate on teams working on intricate, data-intensive stories, their differing skill sets and approaches to problem-solving can lead to misunderstandings and conflicts. The technical nature of coding and the interpersonal finesse required for cultivating sources may seem foreign or inscrutable to those on the other side of the divide. These contrasting areas of expertise can create barriers to effective communication and teamwork, as each group grapples with understanding and appreciating the other's contributions to the project. This breeds unrealistic expectations and disagreements over design choices, stemming from differences between linear text-based storytelling versus iterative data analysis and visualization. As a result, developers feel reduced to graphics-production roles rather than respected as partners in the reporting process.

This analysis sheds light on important implications of the dwindling budgets across the news industry. As financial pressures increase and revenues decline industry-wide, interactive journalism skills in data, graphics, and visualization risk being viewed by shorthanded newsrooms as optional supplementary capacities rather than essential ones. This compounds existing divides separating these professional roles within many still traditionally-structured news institutions. The growing popularity and audience engagement with interactive journalism indicate that its current undervalued position in newsrooms is becoming increasingly misaligned with the evolving preferences of news consumers. Studies have shown that readers are more drawn to visually appealing, data-driven story formats compared to traditional, text-heavy articles. This shift in audience tastes suggests that the marginalization of interactive journalism within media organizations may no longer be tenable, as it fails to capitalize on the potential to

attract and retain readers through more engaging and immersive storytelling techniques. If newsrooms fail to bridge internal divides and recognize these skills as vital rather than additional, they will likely struggle to meet changing audience expectations amid mounting industry challenges.

Tracking the tensions between established and emerging specialties sheds light on pressure points that signal coming transformations for news institutions grappling with significant change. Taking steps to bridge divides today could separate the outlets able to meet evolving audience expectations from those left struggling to adapt.

Literature Review

Interactive journalists experience many challenges in the newsroom because of their unique dual roles as technology experts and journalists. Sometimes these two identities clash or conflict with each other, but more commonly, in their role as technologists, they conflict with traditional journalists. There can be tension between journalists and programmers, or between traditional journalists and interactive journalists, mostly due to their different backgrounds and academic preparation for their roles. These two kinds of professionals do not always understand the role or purpose of the other, and conflict can arise out of this unfamiliarity.

The tension between technologists or programmers and journalists in the newsroom is not a new phenomenon and has manifested in different forms over the decades. Initially, these tensions arose because technologists – programmers, IT helpdesk staff, or general product people – were considered "outsiders" in the newsroom. However, contrary to expectations, as they became more incorporated as "insiders," albeit with different norms, values, and perceptions

about journalism than traditional journalists, working together on editorial content and other journalistic products, many tensions emerged within the newsroom (Usher, 2016). Examining these conflicts provided insights into appropriate journalistic behavior, what is considered deviant, and what is negotiated. Carlson and Lewis's (2015) argument that individual groups working together influence the definition of journalism as a whole can be used to bolster the argument that understanding the influences of developers on journalists or vice versa will help gain clarity on the definition of interactive journalism as a whole. While this has not been studied explicitly for interactive journalism, there is literature about various tensions and negotiations between developers and journalists working together in other journalistic contexts.

Sometimes these conflicts between the two professional groups arise because there are different levels of comfort and acceptance between journalists and programmers in a newsroom. Not all journalists are comfortable with a model of collaboration with technologists, who were previously considered sources or outsiders, and are sometimes not fully trusted with journalistic production (Carlson, 2020). Scholars argue that this could be due to conflicting perceptions about themselves as journalists and programmers as journalists. Though they may be working on similar journalistic products, this perception clash can lead to various issues. Westlund & Krumsvik (2014) argue that it is important to understand journalists' attitudes towards technologists over time, as it is an important indicator of journalism's evolution.

Some tensions arise due to the friction between the different perceived roles of journalists in society. Some scholars argue that journalists who hold older journalism-related functions, such as gatekeeping, tend to prefer the exclusive and authoritative role of knowledge production, creating issues while working with technologists – who prefer sharing and open-source cultures (Müller & Wiik, 2023). Baack (2018) argued that data journalists differ in three aspects: their

positioning, self-understanding of their work, and data usage. On one end are interactive journalists who consider themselves forerunners who can create new media products using their skills, and at the other end of the spectrum are people who argue that these sorts of technical skills are the job of a technical journalist rather than a skill traditional journalists need to learn (Anderson & Caswell, 2019).

The scholarly debates surrounding data journalism provide insights into the different types of data journalists and their perceptions about the current state and boundaries of journalism. Some scholars argue that all journalists should embrace the transparency that comes with open source and technological collaborations, as it emphasizes data sharing and enhances their credibility in the eyes of the public. However, Lewis and Usher (2014) contend that although data journalists have strong connections to hacker cultures, they are reluctant to incorporate data analytics into their stories or ideas because they oppose validation, believing that journalists should maintain their authoritative role. This perspective can lead to tensions regarding the contexts for data usage, whether for stories or analytics, depending on the journalist's alignment within the gatekeeping and authoritative spectrum. While this does not necessarily suggest that issues always arise due to these self-perceptions held by journalists, it does indicate that journalists working with programmers to create editorial content may agree on using data for stories to increase credibility but reject the idea of using data to understand various performance metrics related to their stories.

There are also tensions between traditional journalists and interactive journalists due to different levels of technical acumen and motivations that lead to issues around agency and access. In their research on technological collaborations within newsrooms, Chua and Duffy (2019) suggest that programmers are thought of as overtly and unnecessarily technical,

"marginalizing journalistic issues by making journalistic crises seem merely technical," and entrepreneurial in nature, "preferring technological advancement over the public good, and market-oriented solutions over journalistic democratic functions." Similar arguments suggest that the perception of some journalists about technologists is that they want to build "whimsical, even fanciful solutions to journalism's problems" that may create issues of access for less technically proficient team members (Lewis & Usher, 2016). Tandoc and Oh (2017) point out that journalists struggle when working with interactive journalism because the overspecialization needed for such storytelling formats makes them inaccessible for some team members in hybrid teams. This leads to hesitation about using interactive formats and the perception that technologists cannot build accessible stories in journalism without the help of traditional journalists (Usher, 2016). It appears that programmers continue to have less agency in the newsroom because journalists think that programmers do not fully understand journalism or its functions and are in it to build elaborate technical solutions rather than journalistic stories.

Another issue between the two groups is communication and the lack of a common lexicon. Siitonen & Aira (2019), in their study of journalists and technologists collaborating to build interactive video games, pointed out the issue of steep learning curves and eventual burnout for one or more parties involved in such collaborations. They highlight that technologists needed constant communication, whereas journalists usually worked independently, which caused some discomfort for both parties. They also observed that some journalists needed to learn technical jargon to easily communicate with programmers, which was exhausting for them and led to early burnout causing avoidance of such high interactivity formats. This indicates tensions around different technical know-how, including a common shared language, or the reluctance on the part of both technologists and journalists to learn different skills needed for this

work. These arguments stress the importance of the need for such communication problems to be bridged on a daily basis. In their research about the role of product managers in newsrooms, Royal & Kiesow (2021) argue that the communication problem between programmers and journalists can be addressed by introducing project managers into the newsroom who are conversant in both disciplines and can bridge the gap between these disparate groups. They function as mediators and sometimes interpreters and are becoming more popular within interactive teams today. Communication issues may be more prevalent in smaller interactive newsrooms that do not have mediators, such as project managers, to bridge the gaps.

Another inherent tension is related to the way interactive journalists collaborate with teams of different sizes. Interactive journalists within smaller teams face the issue of "carrying out various tasks" simultaneously as they are usually considered a shared resource for the whole newsroom (Appelgren & Lindén, 2020). Siitonen & Aira (2019) argue that when small teams work on data projects, there is also a mismatch in expectations and timelines due to the team taking on multiple projects simultaneously. In a similar fashion, Stalph (2020) points out that resource-sharing between interactive and data teams can create confusion about the team's function because journalists want to emphasize data for regular reporting and beat stories, while developers want to do more in-depth analysis or investigative stories. In a similar observation, Parks (2015) noted in his study about journalism and technology students collaborating on a project that it was difficult to manage expectations on both sides because journalists tend to have high expectations and ambitious plans for developers. It is evident that the organizational nature of collaborative teams and their logistical everyday functioning can cause tensions between journalists and developers.

Lastly, and perhaps most importantly, are the issues that arise in integrating engineering design and journalism storytelling to build interactive stories. Hultén and Edwardsson (2018) write that challenges in this integration included finding common ground and overcoming obstacles when integrating storytelling and engineering design. Journalists sometimes want lots of text, whereas developers prefer clean aesthetics with little or no text. There is also a sense of concern due to the lack of clear conventions regarding the visual aspects of storytelling and differences in understanding design principles. Similar arguments indicate that there are issues around how much interactivity is desired for the story. Lewis (2015) argues that journalists, who use the inverted pyramid writing style, need story angles to present a story. In contrast, technologists want people to engage with their stories - filter, create, edit, share, and comment on the news. However, Carlson and Lewis (2015) argue that there is also an issue of different ideals between the two groups. They argue over what format would work best for a particular story or come up with ideas that developers sometimes perceive as unrealistic. For example, in Chua and Duffy's (2019) study of data journalists, a developer said, "Some of the hypotheses from journalists do not have fitting datasets that can be analyzed." This can indicate either that journalists do not understand what is required for a successful interactive story or do not want to do much research before passing on the responsibility to developers.

Hermida and Young (2017) examined the challenges of integrating data journalism into Canadian newsrooms and found that there was a need for a cultural shift within newsrooms to fully embrace data journalism. They also highlighted the importance of collaboration and cross-disciplinary teams in overcoming these challenges. Tabary, Provost, and Trottier (2016) investigated the adoption of data journalism in Quebec newsrooms and found that there were several barriers, including a lack of technical skills among journalists, limited access to data, and

resistance to change within newsrooms. They also noted that collaboration between journalists and data specialists was crucial for the successful integration of data journalism.

Uskali and Kuutti (2015) studied the development of data journalism in Finland and found that there were challenges related to the availability of data, data literacy, the technical skills of journalists, and the willingness of newsrooms to invest in data journalism. They also highlighted the need for training and education to support the growth of data journalism.

Findings - Challenges in the Interactive Journalism Newsroom

Data and Interactive Teams Treated as 'Service Desks'

The "service desk" issue discussed in this section refers to interactive journalists and graphics teams being treated primarily as on-demand service providers by traditional journalists, rather than equal collaborators in the journalistic process. As several interactive journalists highlighted in their interviews, some newsrooms view interactive and data teams as mainly existing to provide charts, graphics, and technical support on demand for stories rather than being integrated into the reporting and story-shaping process. This dynamic manifests in various ways, such as withholding credit or bylines from interactive journalists, involving them late or not at all in editorial decisions, and ignoring their inputs and edits on stories. These practices reinforce the perception that interactive journalists are merely technical support staff rather than integral members of the reporting team.

Some interactive journalists reported feeling like "second-class citizens" in the newsroom rather than equal collaborators. Ellis Simani, a data reporter at ProPublica, discussed how this status differential can be subtle: "I think it is more so echoed just in meetings and talking to sources. I just make sure that I am not ever, like just pushed to the side or invited to it like an

afterthought." He highlighted the need to push back against being sidelined and ensure "that you are an equal voice at the table."

What causes this service desk culture to prevail in newsrooms? A key reason is that many newsrooms are still oriented around traditional editorial workflows and hierarchies, where reporters and editors drive stories while visual teams are secondary. Rebecca Pazos, a data visualization editor at The Straits Times, explained the situation in her newsroom:

Our team has grown. It has definitely gained traction in the newsroom, but it is still considered rogue and quite like an extra. It is nice that we have this data team that, in other words, is doing very well, but it is not a core part of the newsroom team. So print is still very much a focus for the Straits Times today. And that is what they have done for ages. And that is what they know how to do." Pazos added that the data visualization team is not integrated into the standard editorial workflow. "It is not like the newsroom said, 'Oh my God, we have to have developers.' It has just always been very separate. The product and engineering teams are their own departments, and not at all editorial.

Interactive journalists face challenges in gaining recognition for their contributions due to ingrained hierarchies and perceptions within newsrooms." Some traditional editors don't see interactive journalists as real journalists," said Rahul Mukherjee, a news app developer at Axios, recalling one editor dismissing them as "news nerds" rather than calling them full-fledged reporters. While most interactive journalists enjoy collegial relationships with colleagues, tensions emerge around bylines, which confer insider status and opportunities for advancement. As Mukherjee put it, "Writing, for me, is another technical skill, similar to coding or design, and analysis. So, it's not one superior over the other; it's all parts of the whole story."

The withholding of credit breeds frustration among interactive journalists like Shirsho Dasgupta, a data reporter at The Miami Herald. "You know, if I don't have any bylines, what am I gonna show?" he asked. Without formal byline recognition, many feel their behind-the-scenes work gets systematically devalued, even as it enables groundbreaking revelations. "It almost feels like then you're kind of using me," Dasgupta said of seeing uncredited data bolster published pieces carrying other reporters' names.

This struggle shapes the experiences of journalists like Agnel Philip, a data reporter at ProPublica. While Philip strives to move into a reporting role, the lack of individual bylines hinders those ambitions. "There's a perception that if there are multiple people on a byline and me as a data reporter, they can't fully understand...what my actual contribution was," explained Philip. Those gaps allow outdated stereotypes about interactive or technology skill sets to persist, even as their work transforms accountability insights.

Singular bylines imply sole authorship rather than the collaborative layering of complementary insights over time. "It makes sense to put you in the byline, it does not make sense to put it with that disclaimer, nope," Philip said, referencing the "data analysis by" credits sometimes appended to delineate his precise role. But relegated to ancillary acknowledgement, the centrality of Philip's databased findings uplifting revelations gets degraded. The data disclaimer situates him as a helpful assistant rather than an equal co-investigator, reinforcing newsroom hierarchies. For immigrant journalists like Dasgupta, who moved from India to pursue his data journalism career, consistent bylines carry escalated urgency. "My need for bylines is almost utilitarian. It's necessary for me to show published work under my name to qualify for the O1 US visa," for individuals with extraordinary ability or achievement, explained Dasgupta. This kind of marginalization within the newsroom fuels imposter syndrome for interactive journalists.

For example, Simani says he feels like a "second class citizen" despite working on innovative new projects. It suggests that despite their contributions, interactive journalists haven't won truly equal newsroom standing as "real" journalists.

Disputes around bylines often emerge from external collaborative projects, where tensions arise over how to evenly credit multiple contributors across various organizations. For example, Philip invested for months collaborating with regional reporters to analyze systemic failures in child welfare policies, but as publication date neared, partner editors balked at listing four ProPublica names alongside their solo journalist. "It looks bad to have so many ProPublica names" dominating, argued his editor, who ended up unilaterally cutting Philip's byline to preserve the aesthetics of the byline section of the story.

"I disagreed with the idea that there was a limit on the number of people that can be on a byline," Philip said. But when structured resolution frameworks are absent, reporter seniority, newsroom conventions and editors' frivolous choices tend to prevail. "And if you're not involved in it directly and only provided visuals, we're not in the conversation and can't make our case for why or raise an objection directly," he noted.

When collaborating with renowned international media organizations, freelance data journalists like Luiz Toledo from Brazil often encounter imbalanced power dynamics that can impact their work and recognition. Though resource-constrained, Toledo's outlet generated accountability insights from documents that reached elite Western publishers. However, Toledo recently accused The Times [UK] of completely plagiarizing a NeoFeed investigation without any attribution. "They just copied my article and didn't give me the credit." Despite appeals as the violated party, the large organization arrogance prevailed. "They decided to delete the whole article rather than just give me credit...If you go to the link, you will see 'This article was

removed," Toledo said. For journalists trying to establish themselves, such brazen content theft signals profound industry disregard of the work interactive journalists do. "I thought they would just change and put the credits, but they decided to delete the whole thing."

While byline disputes are prevalent, the data suggests that they are not universal. Some interactive journalists benefited from the advocacy of predecessors who established that data analysis and visualization were critical storytelling methods warranting byline credits. As Simani notes, "I was fortunate to come into the organization at a time where there had been a lot of data reporters, you know, folks with specialty skills that had laid the groundwork of explaining the importance of the work we do, and that that importance should be reflected with a byline."

For others, clear internal policies dictate byline eligibility. Rachael Dottle, a graphics journalist at Bloomberg News, shares that at her publication, "if I contributed anything to the analysis, or like the reporting, or if I did any of the writing, I usually get a co byline. And if it's a story that I've done myself, I pretty much always get the lead byline." Similarly, Pazos notes that at her organization the secret recipe for bylines was that, "if you took that person out of the story, and the story would have been any different without them, then they deserve a byline."

Philip added that at ProPublica when a key data finding surfaces prominently in the crux of a story, that often translated to a byline. He said,

The standard typically is, if a finding of ours [data analysis team] goes into your nut graph of your story...nut graph means different things to different people to different people, especially in our stories where the nut graph can be like, the one data point of infection rate, because you know, the narrative is like 1000 words before you get to any data related, then we get a byline."

When interactive journalists don't have predecessors who established policies and norms recognizing their contributions, the onus falls on individuals. There are several tactics they may employ to secure credit in the absence of institutional support. For one, taking an assertive stance can be an effective strategy for interactive journalists to get recognized. As Mukherjee explains, "I have no problem fighting for my byline, because in a lot of the work I do, I report myself or I pitch stories and work with reporters. So when I conceptualize a piece or play a big part in the reporting, I have no problem pushing for a byline or just putting it in there to start with." Directly asserting byline claims, inserting your name forcefully when warranted, and not waiting for others to bestow credit demonstrates an aggressiveness that can produce results.

Others seek out internal advocates, a strategy Philip falls back on, now and then, "We're not involved in it directly. We're not in the conversation and can't make our case for like, why or raise an objection directly," but identifying advocates, colleagues or editors, who understand the value of interactive work and can make a case for bylines is key. In some cases, appealing to higher authorities in the newsroom through organized action by leadership or unions proves effective. Adrian Blanco, a data journalist at The Washington Post, recounts, "the graphics director and the graphics leadership fought for this for many years. And it's not an issue anymore, you just have to trust them."

Interactive journalists sometimes receive alternative forms of recognition, such as "data analysis by" or "graphics by" credits, when their requests for traditional bylines are denied. Though not a reporter title, these listings still indicate contributorship. Contribution credits feel inferior to reporter bylines for some, but do communicate roles to the reader, "The data analysis byline thing was initially weird, because I hadn't seen that before. And that was kind of a new thing that was created, because of some of the tension of those conversations between us and

partners of like, you know, resistance to putting us on as a full bought full byline or whatever. This was a compromise that was reached. So initially, when we started doing it, I was like, Why? Why am I getting singled out for this new thing that we've never done before? But now we do it consistently, and I have to be okay with it." He adds that "I don't personally see a huge issue with, you know, erring on the side of giving more people by lines than less."

Transparency about byline policies also enables interactive journalists to assess if they align with values of the organization before joining. As Dasgupta explains, "I directly ask them in interviews, you know, how do you feel about the reporters working on data projects? What makes a byline? What makes a contribution line?" Understanding the norms upfront prevents surprises down the line.

For those at established publications like The New York Times and The Washington Post, this issue feels less urgent. As Pazos said, "If you work at legacy media organizations like WSJ or Washington Post or the New York Times, you can say 'Forget about it' because there isn't really a fight to establish whether what interactive journalists do is journalism." When organizational recognition of the journalistic value of interactive work is firmly entrenched in policy and practice, byline debates dissipate. However, at smaller or newer media startups, securing bylines remains an ongoing process integral to cementing the newsroom role of interactive journalists.

Collectively these experiences serve as yet another illustration of the ongoing tensions between traditional journalism and interactive journalism, with interactive journalists enduring a continuum of slights - from outright erasure of their work to merely cursory accommodation. Their battle for equitable recognition in both newsroom culture and public acknowledgment remains ongoing. But each small byline gained brings more visibility to their indispensable

contributions that too often go unseen. While the struggle for byline recognition captures one dimension of the 'service desk' perception of interactive teams' roles, another key challenge they face in establishing standing is their level of involvement in the editorial process. This manifests in two main ways: the timing of when they are brought into projects and the extent to which their inputs and edits are incorporated.

Interactive journalists are often brought in late, primarily for production support rather than upfront consultation and collaboration from the early stages of story development. Rather than including them from the start as stories are developed, they are relegated to execution roles closer to publication time, constraining their ability to contribute more broadly. Philip explained that "the ideal scenario is that the traditional reporting and the data reporting are kind of done, both concurrently and kind of interacting with each other so that you know that they both shape the direction of the story." However, sometimes his team is brought in later "in the middle of the project, or we did not know that there was going to be data in a story, but then we got this big data set, and we are trying to figure out what to do with it."

Moreover, even when interactive journalists are involved and contribute significantly to a story, their inputs and edits may be overlooked or dismissed. Stories may be edited and changed without their consultation, despite their valuable insights. Simani pointed out that while getting a byline is important validation, the key is "that you end up being an equal part in all other parts of that process. You treat me like a stakeholder. Yeah, I think that is the most important part." He described situations where "maybe an editor does not necessarily ask you as many questions as they otherwise would, maybe they go in and edit the copy without checking with you first." Lim also experienced having his edits on stories ignored:

I did propose edits to the standard first headline and maybe just some copy editing too, like some of the headings and moved some text around and they are okay, but the minute I say, 'Oh, I think this writing style here is confusing. I think it should be changed.' The editor and journalists decide not to address it." He felt uncertain about how much he needed to invest on stories with his byline. So there is just a little bit of tension with this, and it will never be clear to navigate.

Interactive journalists shared various approaches they use to deal with this situation in the newsroom. Some discussed the need to be assertive or "pushy" when sidelined. Simani said,

"I think I can be pushy. I have not had to be. Fortunately the last couple years, just because, I think I have been working with, you know, a set team and someone who I have a really good rapport with. So I do not need to exercise those pushy skills as much. But in the past, I have sometimes had to speak up a little bit more. You have to. I think an important thing to realize is, I am also a younger journalist, especially one of the only Black journalists within the context of ProPublica so I need to speak up.

Another strategy is asking to be involved right from the start of projects as an equal collaborator in shaping the direction of the story. Aeindra Rininsland, a data journalism engineer at the Financial Times, discussed the importance that, "involving journalists enough within the development process, and the ideation process, and the design process, whereby they feel that they have had some involvement with this." She also highlighted the importance of

communicating expectations, expectations very early on. The projects I work on that go off the rails, are ones where expectations were not communicated well.

And, or they were communicated at one point but were not really communicated throughout the process.

Some interactive journalists discuss gaining more respect and clout within their newsrooms by consistently producing standout visual stories and data projects that win awards and get strong audience engagement. Pazos explained how her team had gained more sway as their success and recognition has grown:

because I think over the years, we continually are producing projects that are good, not as good as some of the other places, but we are progressing, we are trying to get better. So what happens is, as we win awards, it has helped establish our presence in the newsroom. Yep.

However, Pazos also discussed the double-edged sword of gaining influence through successful projects, as it has also ramped up expectations and pressure to churn out viral and award-winning visual stories constantly. Reflecting on this cycle, she hoped "eventually we get more and more power in the newsroom to push back against these demands."

Alternative crediting methods, such as "data analysis by" or "graphics by" acknowledgments, represent potential strategies for mitigating the "service desk" mentality that often relegates interactive journalists to subordinate roles. While these approaches can provide some recognition for their contributions, they are unlikely to fully resolve the underlying tensions and power imbalances within newsrooms.

For example, ingrained assumptions that relegate developers to production support roles may be slow to change, especially amid newsroom resource constraints. Additionally, some journalists may continue viewing coding skills as impenetrable rather than essential to storytelling. Until data and visualization capacities are embraced as core editorial competencies,

rather than supplementary, full collaboration will remain challenging. Thus while promising, these bridging approaches alone may not swiftly dissolve persisting divides. In the meantime, the one thing that can be done to change this unequal status between interactive teams and traditional editorial roles is to treat them as reporters and story collaborators, not just as a production team serving others' needs. As Mukherjee said, "For starters just getting respect as a reporter and being treated equally as a reporter [would help]." However, the interviews also raise an issue that this dynamic will likely remain a source of tension rather than being quickly resolved. Pazos reflected that "the political struggles sometimes get to me a lot, just constantly having to fight for the importance of visual journalism." Reorienting established newsroom hierarchies and workflows is an uphill battle.

In conclusion, the "service desk" mentality prevalent in many newsrooms poses significant challenges for interactive journalists seeking to establish themselves as equal collaborators in the journalistic process. This dynamic manifests through inconsistent byline allocation, late involvement in projects, and the dismissal of their editorial input. Interactive journalists employ various strategies to assert their value, such as being assertive in claiming bylines, seeking internal advocates, and leveraging the success of their projects to gain influence. However, these efforts alone may not swiftly dissolve the ingrained hierarchies and assumptions that relegate interactive teams to subordinate roles. Achieving true equality will require a fundamental shift in newsroom culture, recognizing data and visualization skills as core editorial competencies rather than supplementary production support. Until interactive journalists are consistently treated as reporters and integral story collaborators, the struggle for equitable recognition and meaningful integration into the journalistic process will persist. Reorienting established power structures and workflows will likely involve ongoing advocacy and resistance

from interactive journalists, underscoring the need for sustained efforts to drive meaningful change in the industry.

Everyday Professional Blindspots: “They Just Don’t Get It!”

Journalists and developers have traditionally inhabited disparate worlds, with distinct terminologies and workflows that can lead to frustration when collaborating on data-driven and interactive stories. The differences in the professional backgrounds and approaches to problem-solving of interactive journalists and traditional journalists can create barriers to effective communication and integration of their skill sets. Traditional journalists, accustomed to the realm of reporting and storytelling, may struggle to grasp the technical intricacies of coding and data analysis. Conversely, interactive journalists who are well-versed in programming and software development may find the nuances of traditional journalistic practices and editorial decision-making by traditional journalists foreign. These divergent perspectives and expertise can hinder the smooth execution of projects that require a blend of traditional journalism and interactive elements. The interviews pointed to two primary gaps in understanding that underlie frequent communication rifts between developers and journalists in newsrooms: developers may lack familiarity with the intricacies of journalism, while reporters often don't grasp the realities of programming work.

Upon entering the news industry, many developers need help grasping basic journalism tools and procedures of journalistic work and culture. Alex Lim, a data reporter, described jargon posing persistent obstacles for technologists, such as "learning what TK stands for and what like head and deck and subbing and all that means." Beyond semantics, Manas Sharma, a data journalist at Reuters, embarrassedly revealed that when starting out, he was unaware of what

even a basic byline meant, much less "philosophies around framing and context considered standard for seasoned reporters."

For developers from technology backgrounds, interviewing techniques and storytelling are often entirely new skills that often seem hard and take time to develop. Agnel Philip, a data reporter at ProPublica, described investigative reporting's "depth of questions and obsession over details drastically different" from any visualization-focused data work. However, he felt confident that "getting 'more reps' doing interviews and sourcing" would help close self-perceived competence gaps in softer abilities that are less innate among technical staff wired for quantification. Developers sometimes even view data-driven projects as relatively straightforward compared to the challenges of investigative reporting and building trust with sources. Shirsho Dasgupta, a data reporter at The Miami Herald, provided perspective from the programming side, contrasting intense confidential sourcing exposés against "easy" data-driven projects. He said, "Data work is almost easy because, yeah, fine. You take an agency to court and then you get the data." Sustained engagement with sources and "building that kind of trust cannot be done quickly," he added.

On the other hand, journalists often lack intuitive understanding of programming processes and limitations. They struggle as visual thinkers, fail to grasp iterative constraints, and are too heavily invested in their own text to readily accommodate visualizations. Sondre Solstad, a data reporter at The Economist, amusingly compared some reporters to grade schoolers, hoping he magically might "make them a website" armed with nothing more than immense spreadsheets packed with each data point they consider attractive without any further strategic guidance. Aendra Rininsland, a Financial Times Data Reporter Engineer, said that it sometimes helps to proactively develop internal documentation on her team's programming capabilities and push

design workshop collaborations to deter or redirect well-intentioned but counterproductive visual suggestions since "usually their ideas around UX are terrible."

Traditional journalists also grapple with understanding the implications of revisions on project timelines, complexity, and the capabilities of visualization and interactive teams. Christopher Udemans, a data reporter at The Straits Times, indicated that traditional reporters, especially those who continually assume charts and images work exactly like text, quickly reorganize and rearrange to accommodate new material or assertions even at the tail end of production. However, requesting alterations very late after initial specifications and wireframes get approved proves severely misguided, inevitably "pushing deadlines quite substantially on the development side to reprocess underlying data calculations, reformat axes, test across browser platforms, and implement quality assurance checks."

Some traditional journalists underestimate the effort required for seemingly simple visualization changes, which can require extensive behind-the-scenes work from developers. Solstad noted that accurately assessing effort levels for common visualization modifications generally proves difficult even for more digitally-savvy journalists lacking hands-on experience building complex graphics daily. While a change like altering descriptive label wording may seem trivial from a content perspective, updating text styling and alignment alone could require dedicated developers to invest two total hours reconfiguring annotation layers unexpectedly.

Unrealistic production schedules set by journalists lead to last-minute feature requests that overload interactive journalists and result in both parties making reluctant compromises on the final product. Stephanie Adeline, a designer, indicated prolonged scope negotiations now frequently conclude with "both parties reluctantly compromising just enough functionality to

reach minimally viable shared acceptance," allowing high-profile analysis publication by pressing deadlines but leaving everyone dissatisfied. Compressing technical pipelines inevitably overworks developers, making them feel like visualization factories, while journalists watch imagined interactivity whittled down to generalized static images and are disappointed. The only workaround is a longer runway for marinating ideas, but the news cycle is too fast.

Also, traditional journalists' attachment to their writing often lead to excessive text length, disproportionate focus on prose, and resistance to fully embracing visual components in data stories. This sometimes leads interactive journalists to demand more independence rather than collaborate. Edit Gyenge, a data journalism freelancer, bluntly stated after collaborating with different media organizations in Romania that "Journalists always find the topic, do the research, they write the text, and the text is very important to them." Even when she actively identifies passages better translated into charts or diagrams during story formulation, many reporters preemptively resist omitting or condensing any elaborative text they have written. Despite personally disliking drafting content, she admits to moving to a more independent contractor role where she handles nearly all writing herself instead of debating merits and demerits of other journalists' writing.

Journalists and developers often have different perspectives on the appropriate level of detail and depth in data stories, which can lead to tension and the need for compromises. Solstad highlighted this recurrent tension between his innate "bias towards more information," manifested through word counts ballooning into the thousands, versus designers demanding austerity and minimalism before considering something complete. He attempts to reconcile both ends by proposing textual fallback options for adding observations excluded from the final graphics. However, when different opinions on how much detail and depth is needed arise, it

often leads to long discussions and compromises. Ultimately, neither he nor visual artists control framing unilaterally, so they "must find mutually acceptable balances between prose elaboration and visualized explanation, even when each side harbors lingering reservations about compromised solutions," he adds.

Differences in technical knowledge and familiarity with data analysis among journalists can lead to misunderstandings and difficulties when working on data-driven stories. Some journalists may lack the necessary skills or confidence to effectively incorporate data into their reporting, while others may be more well-versed in these techniques. This disparity can create tensions within teams, as those with less experience may struggle to fully contribute to or understand the data-driven aspects of a project. Additionally, journalists who are less comfortable with data may be hesitant to ask questions or seek guidance, further exacerbating the challenges of collaboration. These varying levels of data proficiency can hinder the integration of data into the reporting process and may result in missed opportunities to enhance stories with meaningful insights derived from data analysis.

Dasgupta underscored the importance of carefully cautioning team members against over-extrapolating insights from data or utilizing unvetted sources without enough skepticism. Rahul Mukherjee, a News Apps Developer at Axios, reinforced that more access to abundant datasets nowadays paradoxically requires heightened vigilance, stating, "Developers must remind journalists not to take numbers at face value during rapid analyses without interrogating integrity sufficiently. If underlying inputs are collected or compiled questionably, no flashy presentation can rescue the end product from innuendo."

While greater data accessibility enables faster reporting, the quality of the end product relies heavily on critically examining the credibility of the underlying datasets, especially when

working on tight deadlines. Thus, developers emphasize vetting datasets more rigorously before extrapolating essential claims.

Journalists often overestimate the insights that can be gleaned from custom quantitative analysis due to limitations in the available external datasets. Mukherjee recounted one team insisting on incorporating a county-level homelessness map application within a localized story effectively visualized by his team with static neighborhood bar charts alone. Despite politely trying to understand why existing diagrams were insufficient, the reporters reflexively refused to reconsider their tangential ask requiring months of data collection across bureaucratic silos, never offering satisfying public-interest justifications beyond the want for dazzling complexity. Mukherjee ultimately only "secured approval after getting their editor to reinforce his judgment call" through a bureaucratic override, a tactic always bittersweet. He speculated that some excessive feature requests stem less from informing audiences than garnering homepage placement and social media traction around "look what cool thing we built" bragging rights. However, restless reporters rarely apply strategic criteria or frameworks to validate whether proposals fill substantive gaps instead of demonstrating technical prowess.

The lack of data proficiency among many journalists can lead to challenges when they collaborate with developers, such as setting unrealistic deadlines, misaligned expectations about data, and difficulties effectively executing data-driven stories. Lim summarized the resulting frustrations: "a lack of understanding about what it takes to build a graphic story and how much effort and time it takes and just saying we need this now, or even worse 'We need this yesterday'." Quick-turn daily reporting requires consciously tempering ambitions on technique feasibility, while more extended investigations offer some liberating space to demonstrate complete operational excellence for audiences. However, unrealistic hopes mean developers

invest unreasonable off-hour spans compensating or underutilizing their skills, rushing primary-color bar charts out.

Some newsrooms, particularly those focused on data-heavy topics like finance, employ journalists with stronger data literacy skills, which enables smoother collaborations with developers. Financial journalists at outlets like Bloomberg have built strong data literacy, according to Rachael Dottle, a graphics journalist at Bloomberg News. She described the journalists she works with as displaying "literate sophistication talking about graphics' vocabulary" while "finding data that might work for their story." Concentrated analytics training, financial domain expertise, and repeated cross-disciplinary collaborations better equip these journalists to work with data than general assignment reporters in less quantitative realms.

Effective cross-disciplinary communication and involvement throughout the creative process is crucial for harmonious execution of data-driven stories. As Weihua Li, a graphics editor at The Marshall Project, indicated, "The challenge sometimes is kind of translating, explaining the vision that I have in my head to the designers and the developers." Without continuous collaboration, the final product may suffer from misaligned expectations and visions.

To preemptively traverse these everyday blindspots and mitigate the immense dismay caused by communication breakdowns, journalists and developers have employed several deliberate strategies. The most common strategy that emerged was to set clear expectations very early during initial scoping conversations, then revisit emerging priorities regularly as needs evolve. Rininsland compellingly stated that the projects going most irretrievably awry are ones where "expectations were not communicated...throughout the process" at all levels, technically but also regarding audience goals and measures of success. Regarding development needs, Lim highlighted the importance of communicating expectations throughout the process at all levels to

avoid projects going off-course, pointing out that "gaps inevitably arise if guidelines sit vague or untethered from organizational realities" and realigning priorities becomes critical with shifting news cycles.

Mukherjee advocated envisioning a coherent interactive data project by working backward from impressive but unclear ideas to identify well-evidenced analytical claims for visual presentation. He suggested that "data's narrative relevance should determine ideal formatting, not induce formats artificially just to enable preferred interactive elements chasing audience scale over illumination."

Li highlighted the effectiveness of politely requesting assistance from developers as a strategy to catalyze progress. She emphasized that even brief assists can make a significant difference, citing how politely asking interactive journalists "to spend 30 minutes on my pull request" typically suffices for gaining critical refinement or finishing touches. Rebecca Pazos, a senior graphics editor at The Straits Times, emphasized truly inclusive daily check-in conversations exploring precise design directions and deliberating detailed decision trade-offs to unlock elegant collective solutions exceeding any individual imagination. She stated, "My favorite part about this job is when the team and I discuss what direction to go on certain things...those collaborative conversations in the team." However, reaching that collaborative utopia requires establishing enough baseline mutual fluency for all participants to feel heard and valued during good-faith debates.

Li emphasized the need for flexibility in packaging handoffs to empower coders in driving optimal technical directions. She detailed, "By detailing multiple sound options distinguished by priority for adaptive consideration, reporters enable tailored collaboration matching strengths. Developer autonomy thus unlocks new possibilities." She also stressed the

importance of small courtesies in reframing conversations, advising reporters to issue invitations through inclusive language rather than making demands. She highlighted that "Remaining open to inputs and adaptive approaches" allows progress and creativity to spread laterally during fluid inspiration.

While maintaining courtesy and politeness is crucial in discussions, it is equally essential for both parties to establish non-negotiable parameters. Just as Solstad stressed the significance of setting clear guardrails and embracing visual restrictions for effective communication, individuals must recognize and communicate their non-negotiables. This ensures a "constructive dialogue where both perspectives are considered, fostering compromise solutions rather than outright rejection of suggestions."

In cases where these approaches fail to yield the desired results, the situation may deteriorate, necessitating a more assertive stance. Interactive journalists may find themselves in a position where they must negotiate or argue their case, armed with compelling evidence and strong support from allies within the organization. This can involve meticulously documenting their contributions, presenting concrete examples of how their work has enhanced the quality and impact of the stories, and rallying the backing of influential colleagues or supervisors who recognize the value of their expertise. By building a persuasive argument and leveraging the support of key stakeholders, interactive journalists can more effectively advocate for their rightful place as equal partners in the newsroom and push back against the marginalization of their roles.

Lim advocated justifying format choices by referencing established best practices at admired outlets like Reuters. He cited this as a way to lend credibility when facing skepticism.

At other times, seeking peer opinions to validate judgments helps resolve conflict by building consensus. As emphasized by Mukherjee,

I'll do a gut check. I know this does not need to be interactive. And so I'll say that this is what I think based on what you said, and if you disagree, well, my editor and another experienced journalist on my team also said this. And they backed me up on this

Overcoming divides ultimately requires extending goodwill across departments, translating foreign lexicons, decoding obscure expressions, revealing unseen labor, and exploring unfamiliar imaginative terrain daily until learning becomes ambient through collaboration.

Discussion and Conclusion

My data suggests that interactive and legacy journalists struggle around issues of professional identity, collaboration, and recognition in the newsroom. These tensions emerge amid enduring traditional news hierarchies still anchored in conventional reporting structures prioritizing prose over datasets, incrementalist newsgathering over iterative design, and individual bylines over collaborative layering of complementary insights.

If we leave the mismatches between specialized skills powering journalism's evolution and lingering conventional assumptions unaddressed, they will widen existing rifts. Currently, veteran journalists rooted in text-centric traditions hold disproportionate influence over editorial strategies and coverage direction. Meanwhile, emerging visual design, data analysis, and development innovators driving format changes remain confined to peripheral packaging roles, merely embellishing predetermined perspectives. Existing research shows that interactive journalists struggle to collaborate with editors and reporters less conversant in the intricacies of

visual design, analytical modeling, and developmental coding increasingly comprising digital story forms (Lewis & Usher, 2014). Unequal standing emerges as unfamiliarity risks relegating those handling graphics, data analysis, and presentation to "service desk" status — executing others' ideas without creative direction-setting influence (Tandoc & Oh, 2017). Bridging this experience gap and shifting ingrained assumptions is key to empowering specialized talents on the frontlines of industry transformation.

Newsroom leaders who recognize the growing importance of interactive teams' skills, and elevate their seniority early on, will be better positioned than those clinging to rigid hierarchies and print-centric models. Those that fail to smooth the ascent of data expertise up leadership ladders risk seeing these journalists break off to launch independent ventures or leave journalism altogether. For now, strains persist as interactive teams navigate predominantly print-oriented newsrooms, struggling to incorporate unfamiliar but vital expertise guiding journalism's digital future. Despite wide recognition that hybrid teams blending complementary abilities can unlock more impactful multi-platform journalism (Siitonen & Aira, 2019), complex social negotiations shape transitional pathways towards parity between non-traditional interactive skill sets and historically dominant reporting elites within still largely convention-anchored news ecosystems (Baack, 2018). The divide between old and new journalism is even more prominent in emerging digital journalism markets and developing nations. Jamil (2023) investigated the digital divide in Pakistani newsrooms and found that while journalists possess adequate operational and reporting skills, they lack formal skills in advanced tools like computer-assisted reporting and data journalism. This skills gap results in poor news verification and conventional data formats, further widening the divide between traditional and digital journalism practices. To bridge this divide, Jamil recommends improving journalists'

media literacy through updated curricula, equal training opportunities, and recognizing the different types of digital capital required. Nevertheless, there are gaps in the examination of constraints on advancement pathways and entrenched assumptions that broadly dismiss the growing centrality of digital specialization. Crucial questions persist about the reasons behind enduring reluctance and stagnation in smoothly transferring hierarchical influence towards equitable integration of indispensable interactive abilities (Usher, 2016), despite consistent audience shifts valuing more visual and data-intensive news products.

The findings suggest multidimensional constraints on advancement opportunities arising from uneven visibility policies and stubborn assumptions persistently undervaluing specialized digital expertise. Unlike scholarship narrowly focused on periodic collaboration strains, interviews highlight external exclusion factors that permeate marginalization institution-wide (Usher, 2016). Despite seismic shifts valuing visual journalism's analytical depth, experiential breadth through interactivity, and data-powered revelations with modern news consumers, established print elites retain disproportionate process control. This sustains stubborn power consolidation amid eroding conventional reporting hierarchies struggling to distribute leadership influence towards smooth integration of emerging interactive skill sets increasingly indispensable for engaging accountability journalism (Stalph et al., 2020; Hepp & Loosen, 2021).

Three key dimensions reinforce the inferior positioning of visual and interactive teams. Firstly, systemic under-attribution of pivotal analysis contributions advances high-profile stories without granting individual credits for data and graphics journalists. Secondly, associated assumptions that digital expertise remains expendable supplementary decoration rather than framing accountability insights prove highly sticky. Thirdly, enduring 'service desk' stereotyping

perpetuates perceptions that interactive teams provide responsive visual story packaging support upon request rather than directing original investigation with autonomy (Müller & Wiik, 2023). Uneven power dynamics persist around editorial control over copy decisions and story angles. Bureaucratic expectations to rapidly produce graphics supporting predetermined perspectives rather than shape overall direction through iterative querying further entrench unequal positioning. Lastly, fundamentally contrasting professional worldviews compound collaboration conflicts between coding-focused developers seeking exploratory fluidity and convention-conscious journalists valuing elaborate sourcing procedures (Hultén & Edwardsson, 2018). In practice, this breeds mutual incomprehension of abstractions underpinning the intricacies of the other's expertise, spawning recurring frustrations.

Legacy journalism institutions grappling with persistent economic uncertainty face significant opportunity costs if they neglect to address the growing challenges faced by digital specialists, who are increasingly relied upon by audiences. Failure to resolve these issues may result in morale declines. It also signals generational disconnections around what capacities modern news provision requires.

The analysis in this chapter suggests that academia overemphasizes resolving episodic disagreements rather than confronting systemic policies, broadly excluding digital expertise (Müller & Wiik, 2023) from rising influence despite growing modern news consumer appetite for interactive innovation. We need to holistically study the constraints facing indispensable hybrid teams directing visual and analytical advancements.

Rather than viewing tensions as discrete cultural collisions, analysis probes systemic exclusion factors woven through everyday advancement and attribution barriers that continually

reinforce interactive journalism's subordinate standing — despite its apparent indispensability for engaging evolving publics through immersive accountability revelations.

As inheritors of eroding conventional reporting hierarchies struggle to manage incremental power transitions, staff focused on visual and analytical innovation driving journalistic resonance with shifting consumer appetites face recurring disadvantages. Constraints span individual career advancement pathways, inconsistent collaborative credit for specialized contributions, and highly limited creative control over overall storytelling or editorial strategy decisions. Thus, findings diverge from prior scholarship, which concentrated narrowly on resolving periodic team disagreements or episodic instances of role confusion. Instead, multidimensional systemic obstacles operate continuously across institutions to undermine indispensable interactive journalism capacity. Uneven transition management risks inertia without holistic elevation towards equitable integration.

Shining a light on the unresolved equity struggles of specialists propelling the evolution of the field, the analysis points to cracks in assumptions of adaptation. It suggests that lasting progress hinges on acknowledging the increasing centrality of interactive elements and addressing system-wide policies that perpetuate disadvantages (Hepp & Loosen, 2021). This spans visibility constraints blocking accredited influence along advancement pathways, unreliable attribution through inconsistent credits failing to link contributions with published impact, and dismissed creative direction over framing editorial strategies and coverage priorities.

One vital obstacle that came out in the interviews is uneven access to reliable public and peer recognition. When interactive journalists lack accurate individual attribution linking expertise to published impacts, it dilutes their social capital. Inconsistent or missing byline credits reduce the visibility of their vital efforts across collaborations. This obstructs specialists'

accumulation of reputational assets connecting specialized contributions to tangible audience engagement. Further investigation using Bourdieu's inequality frameworks is warranted to understand these advancement barriers. The service desk stereotyping dimension connects to enduring debates over journalistic role confusion, which constrains opportunity between technical support and creative direction-setting authority (Müller & Wiik, 2023). Outdated assumptions often persist across institutions that interactive talent merely provides decorative packaging rather than pivotal analysis. This fuels rankings confinement, overseeing execution rather than investigation.

For sustainable evolution, generational perspective shifts recognizing interactive journalism as indispensable to engaging modern news consumers merit embedding throughout foundational training and socialization stages (Stalph, 2020). Smooth progress necessitates moving beyond simply managing occasional team collaboration disputes towards holistically elevating equitable hybridity over sustaining rigid skill set divides that sacrifice indispensable talent propelling journalism's future.

Bridging these divides requires focused efforts to build mutual understanding, open communication channels, and incentives for creative co-development between roles. "The ideal scenario is that the traditional reporting and the data reporting are done concurrently while interacting together," suggests data journalist Agnel Philip. However, pushing past stereotypes of coders and designers as strictly aesthetic support staff proves foundational. For now, small gains through identifying internal translation allies, politely educating colleagues on constraints, and targeting collaborative wins are the most realistic path forward.

Scholars suggest (using Field Theory) that technology-based journalists like interactive journalists can gain better integration in newsrooms by accumulating various forms of capital.

Lischka et al. (2023) explored the professional community of editorial technologists and found that they are in the process of accumulating symbolic capital (recognition), cultural capital (skill-related), and social capital (building enduring relationships) in newsrooms. This capital accumulation manifests in greater integration into newsrooms and receiving more appreciation from journalists. By focusing on gaining recognition for their work, demonstrating their unique skills, and building strong professional relationships, interactive journalists can work towards greater appreciation and integration within their organizations.

This chapter sheds light on the systemic barriers faced by interactive journalists on multiple fronts, including inconsistent byline recognition policies and entrenched "service desk" mentalities that marginalize their roles. Nevertheless, despite these obstacles, individuals in interactive journalism persistently drive the field forward with innovative, visually captivating, and analytically robust work. The next chapter focuses on unraveling conceptions of journalism excellence from an inside perspective within interactive journalism. By tapping into the insights of interactive journalists on the frontlines—including those creating pioneering digital narratives and experts closely evaluating outstanding work—we gain an insider look at the values, practices, and criteria defining award-caliber journalism in this dynamically evolving space. Exploring the standards and innovations championed by leaders within interactive journalism can help decode the multidimensional factors giving rise to new understandings of excellence in the digital era. To make sense of the diverse interactive journalist identities underlying these challenges, the next chapter will provide a reflective taxonomy categorizing the different types of professionals working in this dynamic field. Figure 4.1 is a storyform representation of some of the challenges in an interactive journalism newsroom and how interactive journalists navigate it.

Figure 4.1: A Comic Strip About An Interactive Journalists' Challenges In A Newsroom



GRAPHICS BY AARAV GHOSH ~ TEXT BY APARNA GHOSH

CHAPTER 5: CONCLUSION

The rise of interactive journalism has marked a significant shift in the media landscape, yet the experiences and perspectives of the professionals driving this change remain underexplored. This dissertation helps fill that gap by delving into the evolving identities, roles, and professional challenges faced by the interactive journalists who stand at the forefront of this transformative development in news media (Ausserhofer et al., 2020; Boyles & Meyer, 2016). By delving into their diverse backgrounds, motivations, and career trajectories, as well as the collaborative workflows and newsroom integration challenges they navigate on a daily basis (Borges-Rey, 2016; Fink & Anderson, 2015), this study provides valuable insights into the ongoing negotiation of journalism's values, practices, and professional identities in the digital age (Coddington, 2015; Usher, 2016).

Using a combination of in-depth interviews with 24 interactive journalists and content analysis of 18 additional data journalism award winners' LinkedIn profiles, this research has painted a vivid and nuanced portrait of the pioneers who are pushing the boundaries of journalistic innovation (Hermida & Young, 2017; Weber & Rall, 2012). The findings underscore the multidisciplinary nature of interactive journalism, highlighting the complex constellation of skills and perspectives required to create compelling data-driven and interactive stories that resonate with modern audiences (Tabary, Provost, & Trottier, 2016; Young, Hermida, & Fulda, 2018). At the same time, it also sheds light on the potential tensions and power dynamics that can arise as these diverse actors seek to establish their place and assert their value within traditionally structured newsrooms (Boyles & Meyer, 2016; Lewis & Usher, 2014).

This dissertation argues that the experiences of interactive journalists offer a crucial window into the future of journalism in the digital age (Appelgren & Nygren, 2014; Gynnild, 2014). As data-driven, visual, and interactive storytelling becomes increasingly central to engaging audiences and fulfilling functions of journalism (Borges-Rey, 2016; Young et al., 2018), the integration and empowerment of these professionals within newsrooms will be essential to ensuring the continued relevance and impact of the field (Hermida & Young, 2017; Lewis & Westlund, 2015). By examining the challenges and opportunities they face, this research aims to contribute to a more nuanced understanding of the evolving nature of journalistic practice and the steps needed to build a more equitable, innovative, and sustainable media ecosystem (Fink & Anderson, 2015; Usher, 2016).

This chapter first presents a detailed review of the key findings from each of the three main chapters of this dissertation, focusing on the core questions of who interactive journalists are, what they do, and the challenges they face in contemporary newsrooms. It then synthesizes key insights from across the preceding chapters to provide a taxonomy categorizing the different types of interactive journalists based on their diverse roles, identities, skill sets, backgrounds, challenges, and professional orientations within this emerging domain.

Review of Findings

Who is an interactive journalist?

In Chapter 2, I defined an interactive journalist as "*a professional who combines their commitment for journalism with their expertise in programming, data analysis, and design to craft innovative, impactful, and memorable stories that shape public discourse,*" and explored

their diverse backgrounds, motivations, and career paths, highlighting the field's multidisciplinary nature (Fink & Anderson, 2015; Hermida & Young, 2017). The findings suggest that interactive journalists come from various educational and professional backgrounds, driven by both intrinsic factors like passion for storytelling and extrinsic factors such as the need to build sustainable careers (Borges-Rey, 2016; Usher, 2016).

An anomaly emerged among some international students pursuing interactive journalism careers, with practical immigration needs shaping their paths. Interactive journalists enter the field through various pathways, such as internships, fellowships, educational programs, and self-directed learning (Appelgren & Nygren, 2014; Young et al., 2018). However, self-directed online learning is often the only viable option for those who cannot afford unpaid internships or fellowships. Career trajectories varied based on prior experience, with early-career practitioners often starting with internships or junior roles, mid-career pivoters taking on specialized positions, and late-career pivoters entering leadership roles or pursuing entrepreneurial ventures (Boyles & Meyer, 2016). The prevalence of teaching among interactive journalists was also noted, possibly stemming from the need to supplement income or contribute to the field's future (Borges-Rey, 2016; Lewis & Usher, 2014).

Lastly, the research addressed attrition, with some interactive journalists departing due to burnout or unmet expectations. However, some eventually returned, suggesting the field's strong appeal despite challenges (Usher, 2016).

What does an interactive journalist do?

Chapter 3 focused on the practices and workflows of interactive journalists, highlighting how they combine traditional journalistic skills with advanced techniques in data analysis, visualization, and coding (Coddington, 2015; Young et al., 2018). Their work involves identifying and pitching compelling data-driven stories, conducting research, analyzing complex datasets, and shaping the visual and interactive elements of their stories (Hermida & Young, 2017; Tabary et al., 2016; Weber & Rall, 2012).

The data-driven storytelling process starts with obtaining and cleaning relevant data, followed by analyzing and interpreting it to uncover meaningful insights (Appelgren & Nygren, 2014; Young et al., 2018; Fink & Anderson, 2015; Coddington, 2015). Building data visualizations is crucial, and journalists work with designers and developers to create charts, graphs, maps, and interactive elements that effectively convey the story (Cairo, 2012; Weber & Rall, 2012; Young et al., 2018).

Collaboration is essential, particularly between journalists and programmers, to create sophisticated data analysis and visualization tools (Appelgren & Nygren, 2014; Lewis & Westlund, 2015; Fink & Anderson, 2015; Parasie & Dagiral, 2013). Some newsrooms incorporate tools like ArchieML to facilitate the integration of text and design.

Interactive journalists think strategically about the role of data, visuals, and interactivity in storytelling, aiming to enhance understanding, drive engagement, and create impact (Hermida & Young, 2017; Usher, 2016; Borges-Rey, 2016). They also play a key role in shaping the overall editorial direction of their projects, drawing on their unique blend of technical and

journalistic expertise (Boyles & Meyer, 2016; Gynnild, 2014; Coddington, 2015; Fink & Anderson, 2015).

What challenges do interactive journalists face in newsrooms?

Chapter 4 explored the challenges interactive journalists face as they integrate their work into traditional newsroom structures and cultures (Borges-Rey, 2016; Lewis & Usher, 2014). The findings point to tensions arising from the "service desk" mentality that relegates them to subordinate positions and inconsistent attribution practices that fail to fully recognize their contributions (Boyles & Meyer, 2016; Hermida & Young, 2017).

One persistent challenge is the perception that interactive journalists are primarily there to provide technical support rather than being seen as full-fledged journalists (Appelgren & Nygren, 2014; Usher, 2016). This can lead to a lack of involvement in key editorial decisions, limited opportunities for growth, and a sense of being undervalued (Fink & Anderson, 2015). Another significant finding is the issue of inconsistent and unfair attribution practices that fail to fully acknowledge interactive journalists' contributions (Hermida & Young, 2017). Participants expressed frustration when their efforts were not properly recognized (Borges-Rey, 2016; Usher, 2016). The study also highlighted communication and collaboration challenges, particularly when working with colleagues from more traditional journalistic backgrounds (Gynnild, 2014; Lewis & Westlund, 2015). Differing professional norms, technical fluencies, and approaches to storytelling can lead to misunderstandings and creative tensions (Tabary et al., 2016; Young et al., 2018).

Lastly, the findings suggest that interactive journalists in established publications like The New York Times and The Washington Post face fewer challenges related to bylines and

recognition compared to those in smaller or newer media organizations (Hermida & Young, 2017), suggesting an ongoing struggle for equitable recognition and integration of interactive journalism practices (Appelgren & Nygren, 2014; Usher, 2016).

A Reflective Taxonomy - The Kinds Of Interactive Journalists

The insights gleaned from each chapter of this dissertation culminate in a holistic understanding of the evolving landscape of interactive journalism and the professionals driving this change. By exploring the diverse backgrounds, motivations, and challenges faced by interactive journalists, we have gained a comprehensive view of how this field is shaping the future of news media. This taxonomy, presented in the conclusion, serves to synthesize these findings and provide a clear framework for understanding the different types of professionals working in interactive journalism today. By placing this taxonomy here, I aim to contextualize the insights from previous chapters and offer a cohesive perspective on the state of interactive journalism and its implications for the industry as a whole.

The taxonomy of interactive journalists can be broadly categorized into three distinct groups: Mutants, Catalysts, and Hybrids. The Mutants are boundary-crossers who transcend traditional silos, acquiring formal education or certifications in domains outside their origins, such as journalists learning computer science and design or vice versa. The Catalysts are the driving forces behind interactive projects, bridging the gap between traditional journalism and immersive, data-driven experiences. The Hybrids are a new generation of interactive journalists who enter the field directly after completing interdisciplinary undergraduate programs that blend journalism, digital media, and technology. These categories are based on the level of expertise

and the investment they put in – both financial and hard work, and hence are mutually exclusive. For example, if a Mutant or Catalyst spends enough time in an interactive newsroom, say about 10+ years, they eventually go from novice to expert. But they can never be a Hybrid because they did not start off with these levels of expertise from their interdisciplinary training. That said, it feels like every category is striving to reach the expertise levels of a Hybrid.

The plethora of terms used to describe interactive journalists reflects the multifaceted nature of their work and the communities they serve. While these numerous terms can make data collection and analysis challenging, it also sheds light on the unique contributions these professionals make to the field of journalism. Interactive journalists, regardless of their specific titles or areas of expertise, employ their skills in design, engineering, and storytelling to create engaging and informative content that reaches a wide range of audiences.

Just as engineers specialize in different areas to serve specific needs, interactive journalists adapt their approaches to cater to the requirements of various communities. Some may focus on creating data visualizations that make complex information more accessible to the general public, while others may specialize in developing immersive, interactive experiences that allow users to explore stories in depth. By tailoring their work to the needs and interests of different audiences, interactive journalists play a crucial role in expanding the reach and impact of journalism in the digital age.

Despite the challenges posed by the diverse nomenclature, recognizing the commonalities among interactive journalists is essential. At their core, they are all journalists committed to using technology and data to inform, engage, and empower their audiences. This taxonomy serves as a reminder that while interactive journalists may take different approaches and serve

different communities, they are united by their shared purpose of advancing the field of journalism through innovation and creativity.

The next section provides an in-depth examination of the taxonomy, pointing to distinct characteristics and backgrounds that define each group of interactive journalists.

The Mutants

Vignette: Christopher Udemans

Udemans' journey began with an undergraduate degree in music. However, his interest in writing and research took shape during this time, planting the seeds for his future transition into journalism.

After realizing he wouldn't become a concert musician, Udemans pursued a postgraduate degree in journalism. "I got a job as a tech reporter in Cape Town," he says, kickstarting his journey into the field. However, his initial role was not entirely fulfilling, as he explains, "We were covering tech and startups across Africa. And we had like four reporters. And so that just wasn't working. And so we ended up doing a lot of press release journalism. Press releases, rewriting them, I don't want to call it journalism. I hated it."

Dissatisfied with the kind of arm-chair journalism he was doing, Udemans moved to China, where he taught English for a while. It was during this period that he stumbled upon a Python tutorial by Ben Welsh from the LA Times, which ignited his passion for coding and data journalism. "So that led me into learning to deal with data to code," he recounts. Udemans continued to be dedicated to his learning of new skills. He took numerous courses on platforms like DataCamp, expanding his skills in data analysis, visualization, JavaScript, and D3.

Equipping himself with the skills landed him in his current role as a digital graphics journalist at The Straits Times. In his role at The Straits Times, Udemans wears multiple hats – journalist, designer, and developer – weaving these disciplines on a daily basis to craft compelling data-driven stories. The projects he works on span a wide spectrum, from deep dives into complex datasets to innovative experiments melding journalism with emerging technologies.

The project that Udemans was proud about was a visual exploration of the supply chain crunch, where he tracked the journey of a bicycle from China to Singapore, using its odyssey as a metaphor for the global disruptions. Another standout piece was an interactive map that allowed users to input their addresses and identify dengue clusters in their vicinity – a prime example of public service journalism that empowers readers to make informed decisions. But Udemans' appetite for innovation doesn't stop there – he has also collaborated on gamified storytelling experiences, like a FIFA World Cup feature that challenged readers to recreate iconic goals through an interactive game. He recently enrolled in a master's program in data science at the University of London, driven by his newfound love for natural language processing and machine learning.

What are their characteristics?

This synthesis explores the narratives of a distinct group of professionals, whom I refer to as "The Mutants," who have emerged as boundary-crossers in the field of interactive journalism. These boundary-crossers transcend the traditional silos of journalism, computer science, design, and even unrelated disciplines, united by a shared pursuit: attaining formal education, or skills certifications in domains foreign to their origins.

Among The Mutants, a compelling pattern emerges. Those rooted in journalism are increasingly drawn to computer science and design education, almost out of professional necessity. The precarity of legacy journalism roles has made adaptation a matter of survival in an ever-evolving media landscape. Interactive journalists like Christopher Udemans, who transitioned from a music degree to a post-grad in journalism before finding his niche in data storytelling at The Straits Times, Adrián Blanco Ramos, an interactive journalist who got a job at El Confidencial after five internships and a masters in data storytelling from Columbia University, and Aendra Rininsland, who self-taught herself skills like JavaScript and d3 after studying interactive journalism at City University, are some examples of journalists that have made this pivot. They integrate technical prowess into their journalistic foundations to thrive in data and interactive spheres. As Rininsland reflects, "Even though my background is very much editorial journalism...what pays the bills in my career has always been tech skills."

This cross-pollination flows in both directions. Computer scientists and designers are also making forays into journalism, lured by the nuances of compelling storytelling. Marije Rooze exemplifies this trajectory, bridging her technical background in data analysis and design with journalism through a master's at the University of Amsterdam that spanned new media, visualization, open data, and online journalism after obtaining bachelor's degrees in ICT and interaction design.

And then there are The Mutants whose origins lie elsewhere entirely - neither in journalism, computer science, nor design. These individuals, like Maya Miller who transitioned from an undergraduate degree in international studies from the University of Wisconsin-Madison and six journalism internships between 2012 and 2016 to a master's program in data journalism at Columbia University in 2017, discover journalism along the way through experiences,

eventually pursuing interactive journalism degrees to amalgamate their eclectic backgrounds with multimedia storytelling skills focused on techniques like Python, R, science journalism, and storytelling strategies.

The timing of this pivot in these interactive journalists' lives varies, from a couple years into a career to over a decade of prior experience. But whether pivoting early or late, most Mutants gravitate towards formal education as the gateway, often enrolling in master's programs. Their journeys diverge from this common fork. Early transitioners like Adrián Blanco Ramos, who did several internships, and Marije Rooze, who interned at various media outlets, accumulated internship experiences before landing coveted roles. In contrast, late pivoters such as Karthik Patanjali transitioned directly into leadership positions at places like The New York Times as a graphics and multimedia editor after a decade working as a graphics and product designer.

Within newsrooms, the roles of Mutants are shaped by the organization's size and structure. In larger newsrooms with dedicated interactive teams, like Adrian Blanco Ramos' experience at The Washington Post, they operate independently, collaborating with traditional reporters primarily on major investigative projects. But in smaller, conventional settings, Mutants pioneer interactive journalism almost single-handedly, introducing novel practices while juggling traditional reporting duties. "I am the only data journalist, so I work by myself all the time," said Laura Aragó of her experience at the newspaper La Vanguardia in Barcelona. This duality becomes a significant challenge. Mutants in leaner newsrooms face the precarious perception of being dispensable resources, pressured to maintain a frenetic publishing cadence that pits their interactive journalism ambitions against the daily grind of churning out stories as traditional reporters.

The pivot is not the end of the learning journey. All Mutants are continuously upskilling to keep pace with rapidly evolving technologies that redefine their craft. As Weihua Li said, "The ability to find resources to figure out how to acquire skills that you need to be successful was something I definitely got from attending Columbia and really appreciated it" - a sentiment that captures the Mutants' commitment to self-learning through skills courses, certifications, and online tutorials to learn new tools and coding languages as technologies are outdated, revised or introduced consistently.

The Catalysts

Vignette: Sondre Solstad

With a PhD in International Relations and a background in game theory and statistics, Solstad's path was initially headed towards academia. However, his passion for writing and desire to make a significant impact led him to explore the world of journalism. Solstad's experience with writing began long before his full-time job at The Economist. "I've been writing op-eds for newspapers in Norway for a very long time, since high school," he shares. "I had a column for a couple of years. Well, one year one newspaper, one year in the next." This early exposure to writing for a public audience played a role in shaping his decision to pursue journalism.

When considering his next steps after completing his PhD, Solstad's main criterion was to choose a path where he believed his presence would have the greatest impact. "I figured this would be the best opportunity," he says of joining The Economist. "I did also explore other things... but my metric was where I thought my presence would have the greatest impact."

As an analytical data journalist, Solstad's work involves collecting data, analyzing it, creating visualizations, and collaborating with a diverse team of data visualizers, designers, and editors. His process begins with pitching a story idea to his editor, followed by research and data gathering. Solstad's expertise in causal inference and statistical modeling allows him to uncover meaningful insights from complex datasets. A typical day in Sondre's professional life is marked by statistical analysis, number crunching, dataset cleaning, and model building. One of his notable projects involved the creation of models to estimate global COVID-19 deaths, the pandemic's true death toll, which he believes to be "the most accurate by far on the planet." He points out, "It was groundbreaking at the time, and still is - no one else has done this. Organizations like the WHO rely on my COVID estimates." This project showcases his commitment to providing accurate, impactful information to readers worldwide.

Solstad emphasizes the importance of collaboration in his work, particularly with data visualizers. "My expertise is not making the best data visualizations possible. My expertise is supplying the insight and sort of the data that we represent," he explains. The process of refining visualizations is a back-and-forth one, with Solstad and the visualizers working together to create charts and graphics that effectively support the story's main argument.

One of the challenges Solstad faces as a catalyst is navigating the balance between providing comprehensive information and creating concise, engaging pieces. "I want to have more information on the page. Whereas I think, a data visualizer will want to present as little information as possible sometimes to just make the main point," he explains.

Solstad does not see himself as a journalist "in the classical sense" but instead, he sees himself as an analytical data journalist. Looking to the future, Solstad said that he is determined to continue growing and improving in his role: "I hope to become a better writer, I hope to

continue to improve my base journalistic skills." His expertise has even extended to advising prestigious institutions such as Harvard and MIT on statistical modeling. He is also affiliated to Harvard's Institute for Quantitative Social Science, which allows him to stay informed about new methods and techniques that can be applied to his work.

What are their characteristics?

These individuals, whom I call "The Catalysts," are the driving forces behind interactive journalism projects. The Catalysts bridge the gap between traditional journalism and immersive, data-driven experiences. By combining data analysis with visualizations and interactivity, they create innovative ways for audiences to engage with complex stories and topics.

Rather than pursuing higher education or formal training in journalism, many of these professionals remain focused on their specific areas of expertise, such as data analysis or visualization. They bring their unique perspectives and experiences to the table, collaborating with journalists and other specialists to create interactive projects. Interestingly, many Catalysts stumble into interactive journalism by chance, often through a single project that sparks their interest and draws them in. However, the nature of their skills and expertise also means that they are often more transient within the journalism industry. Some eventually leave to pursue opportunities in more design or technical industries, while others remain committed to pushing the boundaries of what's possible in interactive journalism.

It is worth noting that those Catalysts who cross the seven-year mark in interactive journalism tend to stay in the field for the long haul, often dedicating a decade or more to their craft. This is possibly because individuals have often invested significant time and energy into

developing their skills and building relationships within the industry, making it more difficult for them to leave.

Catalysts face several unique challenges including the perception of being part of a "service desk" within their organizations, issues with bylines and attribution, and the risk of burnout due to the fast-paced nature of the industry and the constant need to learn new skills and technologies. As Manas Sharma explains, "Sometimes, from a data-centric point of view, it's really difficult on the stories we want to tell because we don't have the time to go looking for the data." This pressure to produce compelling interactive content quickly can sometimes come at the expense of more in-depth, time-consuming projects that require extensive data analysis and visualization work. In addition to these challenges, catalysts with technical backgrounds are often treated like IT help and a service desk in their organizations, expected to handle IT support tasks beyond building interactive journalism pieces.

At FiveThirtyEight, Paul Schreiber, a former lead developer, was the "sole in-house engineer" managing a range of IT responsibilities. He "built onboarding tools to quickly set up new hires' accounts and systems" and became "the in-house expert for technical questions" in addition to his editorial projects. Similarly, at Reuters, Sharma played a multifaceted role "toggling between data analysis, visualization development, coding, and IT support tasks as needed." He created internal tools including "a script to quickly configure new hires' laptops with all their account access and software needs" to support the workflow. Catalysts are unhappy about being treated as IT multitaskers outside their core roles, as it took a toll having to regularly pause their main interactive journalism projects to handle IT busywork and "fire drills" in the newsroom.

Another defining characteristic of The Catalysts is that they are always part of teams with other Catalysts or Mutants. These interactive teams balance out each other's skills and complement one another in different ways. For example, at Reuters, Manas Sharma, a data visualization developer, works closely with a team of developers, designers, and journalists-turned interactive journalists. He explains, "Although we all have similar profiles, each of us has a particular area in which we stand out." Within these interactive teams, Catalysts primarily fall into two roles: Data Analysts and Visualization Experts. Data Analysts specialize in gathering, cleaning and analyzing data to surface insights. Visualization Experts then translate those data-driven narratives into compelling visuals and interactives. This collaborative dynamic allows The Catalysts to leverage their unique strengths while learning from one another, ultimately leading to more impactful and engaging interactive journalism projects.

Data Analysts are the foundation of interactive journalism projects. They dive deep into complex datasets, uncovering hidden insights and patterns that form the backbone of compelling stories. With backgrounds ranging from economics and political science to computer science and statistics, Data Analysts bring a diverse set of skills to the table. Individuals like Ellis Simani, a data reporter at ProPublica, Sondre Solstad, a senior data journalist at The Economist, and Agnel Philip, a data journalist at ProPublica, epitomize the role of Data Analysts in interactive journalism. They are motivated by a desire to harness the power of data to inform and engage audiences. Their typical day involves working closely with reporters and editors, cleaning and analyzing data, and collaborating with visualization experts to bring their findings to life. Data Analysts often hold positions that have the word "data" in it, such as data journalist, data reporter, or data editor. They are the go-to experts for traditional reporters seeking to incorporate data into their stories. However, they face some unique challenges, such as ensuring the accuracy

and integrity of data on last minute requests, navigating complex datasets, and effectively communicating their findings to non-technical colleagues.

Visualization Experts, on the other hand, are the artists and technologists who bring data to life through visuals and interactive designs. With backgrounds in graphic design, data visualization, and front-end development, they possess a unique blend of creative and technical skills. Manas Sharma, a data visualization developer at Reuters, Alex Lim, a graphics journalist at The Straits Times, Rachael Dottle, a graphics journalist at Bloomberg News, Edit Gyenge, a data visualization specialist and founder of her own company, and Ferran Morales, an infographics artist at Mundo Deportivo, are examples of Visualization Experts. They usually have the word “visual” or “graphics” in their titles. For example, they often hold positions such as data visualization designer, interactive developer, or graphics editor. They are passionate about using design and technology to make complex data accessible and engaging for audiences. Their typical day involves collaborating with data analysts and storytelling experts, iterating on designs, and coding interactive elements.

With their diverse backgrounds and complementary skill sets, The Catalysts form the driving force behind interactive journalism projects, blending data analysis, visualization, and storytelling to create immersive and engaging experiences for audiences.

The Hybrids

Vignette: Rahul Mukherjee

Rahul Mukherjee is a digital and visual journalist who is at the intersection of data, design, and storytelling. With a unique background that includes computer science, visual communication,

and journalism, Mukherjee embodies the hybrid nature of modern interactive journalism.

Growing up with immigrant parents in Ohio, Mukherjee initially felt pressure to pursue a traditional career path like engineering or medicine. However, he quickly realized that he was more creative and that his true passion lay elsewhere. "I think I got into this because I hated everything else. I was creative, and just like, very bad at engineering," he admits.

Mukherjee's journey led him to Ohio University, where he studied Visual Communication with a concentration in information design. This relatively new program allowed him to combine his love for art and design with his growing interest in journalism. "It's kind of data design and journalism combined into one," he explains. After graduating, he did an internship at the San Francisco Chronicle, where Mukherjee discovered the power of data journalism. "I really fell in love with it, especially the data part, plus what I liked about engineering and combining what I liked about the creative art I did in college and kind of mixing that together."

Now, as a visual journalist at Axios, a startup that focuses on data visualizations and news apps, Mukherjee wears many hats. His work involves analyzing data, creating charts and graphics, and developing interactive web stories. "A lot of what I do involves working with data and like trying to find information, communicate it in a way that words cannot, whether that's through charts and graphs, whether that's through video, whether that's through illustration," he says.

Mukherjee's daily workflow involves close collaboration with reporters and editors. He often pitches his own data-driven stories or works with reporters to enhance their narratives with visual elements. "Sometimes a reporter comes in with a more of a narrative story or like, has interviewed but needs some data to kind of back up the narratives. And then we come in and help bring that data or pull that data set to kind of give context to the narrative story," he explains.

Mukherjee sometimes struggles to gain respect from traditional reporters who may not fully understand the role of data journalists. "I think the two big things are just getting respect, like, as a reporter. Like, being treated equally as a reporter," he admits.

One project that Mukherjee is particularly proud of involved mapping racist school names across the country in the wake of the Washington football team's name change. "It was kind of cool, because I got to experiment with different methods of data collecting," he says. "So I took a database of like school logos, and kind of had an AI run... Logos of teams that have racist icons... And kind of like ran those logos against them to see how close they were to being racist."

For the future, Mukherjee hopes to continue honing his web development skills. "I definitely want to beef up a lot more of my web development skills," he says. He also recognizes the growing importance of machine learning in journalism, explaining, "On the data side, I definitely want to learn more about AI, not necessarily that I would use it more for my reporting, but I want to understand the ethics of using it."

What are their characteristics?

The Hybrids, a new generation of interactive journalists, have emerged in recent years with a unique combination of skills acquired through their interdisciplinary undergraduate education. They often pursue degrees like Convergence Journalism, which blends traditional journalism with digital media, multimedia storytelling, and technology, or programs that combine data design and journalism, as in the case of Rahul Mukherjee's Visual Communication degree from Ohio University, or Youyou Zhou's, a combination degree in visual design and journalism called

convergence journalism at the University of Missouri. Zhou is currently an interactive journalist for The Washington Post.

What distinguishes The Hybrids is their ability to enter the field of interactive journalism directly after completing their undergraduate studies, possessing the necessary skill set to contribute to data-driven storytelling from the outset of their careers. Their proficiency in data analysis using tools like Excel, Python, and R, combined with their design skills and understanding of web development technologies such as HTML, CSS, and JavaScript, allows them to be independent in creating interactive journalism projects.

However, The Hybrids face challenges in gaining recognition and respect within their newsrooms. As a relatively new category of interactive journalists, they may be perceived as specialists or support staff rather than full-fledged reporters, leading to issues with bylines, attribution, and establishing credibility. This perception is similar to the challenges faced by The Catalysts. Within newsrooms, The Hybrids collaborate with traditional reporters and editors to enhance stories with data-driven insights and visual elements. As the field of interactive journalism evolves, The Hybrids have the potential to shape the future of data-driven storytelling. However, they must navigate the challenges of gaining recognition for their journalistic contributions, establishing themselves as journalists.

The success of The Hybrids in the industry can pave the way for more professionals with similar backgrounds to enter the field. If they demonstrate the value of their unique skill set and make a positive impact in their newsrooms, universities may be encouraged to continue offering interdisciplinary programs that combine journalism, technology, and design. This, in turn, could lead to a growing number of Hybrids entering the workforce, further strengthening the role of interactive journalism in the media landscape.

What this does for our understanding and why it matters

It is important to recognize that this taxonomy does not consist of absolute boxes where these journalists fit; rather, it is a spectrum of different levels of blending of education, experience, and experimentation. The golden standard may be to have high proficiencies in computer science, design, and journalism. In the case of hybrid interactive journalism teams, versatility is crucial because interactive journalism is not as expansive or broad as reporting and cannot afford to have its own beats, so they are usually shared resources for the organization. This is typically not the case for smaller, more specialized interactive journalism and data organizations. Interactive journalists with hybrid proficiencies are sometimes placed as individual contributors in certain beats. For example, Rachael Dottle was an interactive journalist for the elections team at FiveThirtyEight, a data and interactive specialized newsroom.

The Taxonomy and Career Trajectories

The taxonomy of interactive journalists (Mutants, Catalysts, and Hybrids) intersects with the career paths of early practitioners, mid-career pivoters, and late-career pivoters discussed in Chapter 2 in several ways.

The Mutants, who are boundary-crossers with formal education or certifications in domains outside their origins, seem to align most closely with the mid-career and late-career pivoters. These individuals often transition into interactive journalism roles after gaining substantial experience in other fields, such as journalism, design, or engineering. They bring valuable expertise from their previous roles and tend to take on more specialized positions within interactive journalism.

The Catalysts, who drive interactive projects by bridging the gap between traditional journalism and immersive, data-driven experiences, appear to be more evenly distributed across the three career trajectory categories. Some Catalysts may be early practitioners who quickly adapt to the rapidly evolving landscape, while others may be mid-career or late-career pivoters who leverage their prior experience to create innovative solutions.

The Hybrids, a new generation of interactive journalists who enter the field directly after completing interdisciplinary undergraduate programs, seem to correspond most closely with the early practitioners. These individuals often kickstart their careers with internships or entry-level roles and are more likely to seek international experiences.

However, it's important to note that these intersections are not absolute, and there may be some overlap between the taxonomy categories and career trajectories. For example, a Mutant with a background in computer science may enter interactive journalism as an early practitioner, while a Hybrid with an interdisciplinary degree may pivot into the field later in their career.

Understanding how the taxonomy intersects with career trajectories can help organizations better support and nurture interactive journalists at different stages of their careers. For instance, early practitioners who are Hybrids may benefit from mentorship programs and opportunities to collaborate with more experienced colleagues, while mid-career and late-career pivoters who are Mutants may need support in adapting their skills to the unique challenges of interactive journalism.

Moreover, recognizing the diverse backgrounds and entry points of interactive journalists can help organizations create more inclusive and equitable hiring practices, ensuring that individuals from various disciplines and career stages have opportunities to contribute to the field.

Limitations and Future Research

This dissertation provides a comprehensive exploration of interactive journalism, focusing on the backgrounds, motivations, roles, and challenges faced by interactive journalists within newsrooms. However, it is important to acknowledge the limitations of this study and the opportunities for future research that arise from these limitations.

One limitation of this qualitative study is the sample size of 24 participants, which may not be representative of the broader interactive journalism community. While the sample size was sufficient for an in-depth exploration of the research questions, a larger and more diverse sample could provide a more comprehensive understanding of how interactive journalism is developing and being practiced in different organizational settings, such as legacy media, startups, and non-profit organizations. Future research could address this limitation by conducting large-scale studies that include a more diverse range of participants and explore the nuances of interactive journalism practices in different settings, as well as how the field is evolving in different geographical and cultural contexts.

Another limitation is the study's focus on English-speaking interactive journalists, which limits its generalizability to non-English-speaking contexts. Cultural and linguistic differences may significantly influence the roles and integration of interactive journalists within newsrooms, as well as the reception and impact of their work among local audiences. To address this limitation, future research could explore the experiences of interactive journalists in non-English-speaking countries, conducting comparative analyses to identify the commonalities and differences in their roles, challenges, and impact across various journalistic traditions and media systems.

The study's narrow focus on the perspectives of interactive journalists themselves is another limitation, as it does not fully capture the viewpoints of other stakeholders within the newsroom ecosystem, such as traditional journalists, editors, and newsroom leaders. Incorporating the perspectives of these groups could provide a more comprehensive understanding of the dynamics and tensions within newsrooms. Future research could involve interviews or focus groups with these additional stakeholders to shed light on the complex power dynamics and cultural shifts that may be occurring within newsrooms as interactive journalism gains prominence.

Moreover, the study does not consider the perspectives of the public, which is a crucial stakeholder in the broader context of journalism's role in democracy. Future research could explore audience reception and engagement with interactive journalism projects, as well as the ways in which these projects may influence public discourse and decision-making. By considering the perspectives of both newsroom stakeholders and the public, researchers could develop a more comprehensive understanding of interactive journalism's role in shaping the future of news media and its contribution to a well-informed citizenry.

The rapidly evolving nature of interactive journalism and the broader media landscape raises concerns about the temporal relevance of the study's findings. Future research could address this limitation by conducting longitudinal studies that track the changes and developments in interactive journalism over an extended period, allowing for a more dynamic and up-to-date understanding of the field.

Finally, while the dissertation provides valuable insights into the experiences of interactive journalists, it does not delve deeply into the specific challenges or opportunities associated with different types of interactive journalism projects or storytelling formats. Future

research could explore the nuances and unique considerations involved in different types of interactive journalism projects, allowing for a more granular understanding of the field and the development of tailored strategies or best practices for each format.

By acknowledging and critically examining these limitations, future research can build upon the findings and insights presented in this study, ultimately contributing to a more comprehensive and nuanced understanding of the field of interactive journalism and its implications for the future of the news industry and journalism education.

Reflecting on Why Understanding Interactive Journalists is Important and Relevant Today.

This dissertation provides a snapshot of the moment where the professional boundaries of journalism became blurry and the metaphorical wall between the reporters and the graphics desk or the IT desk disappeared. It can help as a jumping point when new technologies like AI and concepts like AI generated content (AIGC) are introduced into newsrooms in the future. This dissertation's findings on diverse backgrounds and skill sets can inform strategies for successful collaborations between AI experts, prompt engineers, and journalists - facilitating the effective integration of AI in news production and storytelling. For scholars, the taxonomy of interactive journalism can help understand how the identity of the interactive journalist can inform the challenges and career paths they can navigate. As more technologies become more prevalent in the newsroom, this taxonomy can serve as a framework to understand the backgrounds, values, motivations, practices of future journalism, so that newsrooms can create inclusive and collaborative environments that leverage their expertise for the future iterations of journalism.

This dissertation can act as the foundation to understanding the other side of the story. Really going deep to understand why interactive journalists feel like they are treated like "service desks" can help revise some of the editorial structures and hierarchies that have been around for over 100 years. It reinforces two ways that this challenge can be addressed: one by ensuring that newsrooms develop and have in place guidelines and best practices for interactive journalism; some of those guidelines could include involving interactive journalists early in the editorial process, bylines and attribution policies or standards. The second way that this can be helped is by having an advocate, be it an editor that comes from a hybrid background, or someone who has power but also their best interests in mind. Organizations and leadership need to understand the diverse backgrounds of interactive journalists and also embrace that data and interactive projects take time and cannot be expected for every story or breaking news feature the organization publishes. Maybe journalism can take a page from organizations like Amazon, that have an internal Amazon Technical Academy where you can enroll for a year at a pay cut and move to more technical roles. This can save organizations money that is currently used to hire engineers who cost a lot, and also empower journalists to become more tech-savvy, which means more journalism values within the newsroom.

One thing that was common among all my interviewees was a certain "vulnerability" in the way interactive journalists described their positions in the newsroom. The vulnerability in the interactive journalist community is a combination of uncertainty of their position in the newsroom, precarity of the newsroom and its continuing to do such work in the future, and the lack of an advocate. One more thing is the lack of precedence. Most interactive journalists are either in emerging interactive teams, or are the sole people in these newsrooms. Isolation and

lack of precedence is a huge finding. The other challenge is burnout because interactive journalists find it difficult to keep up with the news cycle.

This dissertation is also a starting point to consider who is in today's newsroom. Are we preparing our next generations to thrive in a newsroom, or are we sending them off with skills that were barely enough yesterday? Journalism programs need to embrace more interdisciplinary approaches: more data analysis, more coding, more design and UX. Narrative writing or magazine journalism can be an elective, but cannot be the whole degree's concentration. For example, when I walked into the Seattle University class to teach "Foundations in Data Visualizations" to a classroom filled with journalism/communications majors, nobody had ever opened either Excel or Google Sheets. It was one of my most fulfilling experiences as a teacher when I saw them present their data projects to the class at the end of the term. Students do not come to journalism school to learn to write, they come to be journalists, and it is our duty as educators to prepare them for what is out there - a newer definition of who a journalist is. This dissertation has a full combined list of skills that interactive journalists need. This is both helpful for educators designing interdisciplinary classes and journalists who want to upskill for contemporary newsrooms and projects. The list can also benefit newsrooms that want to foster learning environments for professional development for their journalists.

For those that know journalism, this may be something different or may diverge from what was traditionally considered journalism, but for a reader, this is just what journalism is today. There is a lot to be learned and gained when interactive journalists are "seen" as journalists. For instance, looking at "what interactive journalists do," it instills the process of journalism that involves pitching, writing and editing. Yes, there are a few more things added on to the writing process - like data analysis and visualizations. Usher (2016) in her book quoted

someone telling them, and they said it right, that interactive journalists are people that “write stories, and then turn around and write code.” This dissertation reinforces that definition for interactive journalists. While technically they may be “coders,” they really are just journalists. With that base understanding of who these interactive journalists are, there is more of a sense of acceptance, oneness, and responsibility within the newsrooms of these journalists. I say this because once newsrooms - both traditional and contemporary ones - start accepting interactive journalists as one of them, a lot of the challenges they face in collaborating with traditionally-minded people, especially editors, can be eradicated. There is a flow of knowledge and synergy that can be compared to traditional journalists coming together for a really big story that intersects both their individual beats. Christopher Udeman’s sums it in my favorite quote from all my interviews:

We're doing journalism. I don't think there's a sense in separating data journalists or graphics journalists from journalists, because in the end, the goal is the same. We're all there to inform and educate. The means by which we do it is slightly different, with some overlap. I think there are reporters who could use numerical and data literacy. At the same time, people focused on the technical side could use on-the-ground reporting experience. I'm hoping in the future, there's less distinction between these two terms and more of a mindset that this person is a journalist, and it's just how they go about the way they do journalism is slightly different.

Christopher Udeman's quote encapsulates the core argument of this dissertation: despite the diverse backgrounds, skills, and approaches of interactive journalists, they are all, at their core, journalists. Udeman's perspective challenges the notion that data journalists or graphics journalists are separate from traditional journalists, emphasizing that their ultimate goal – to inform and educate the public – remains the same.

This quote is important because it highlights the need for a more inclusive understanding of journalism in the digital age. By recognizing that the means by which journalists achieve their goals may differ, with some focusing more on data analysis and visualization while others prioritize on-the-ground reporting, Udemán suggests that these differences should not overshadow their shared purpose. His call for less distinction between these terms and a greater emphasis on the mindset of being a journalist underscores the importance of fostering a more unified and collaborative approach to journalism, where diverse skill sets are valued and leveraged to create more comprehensive and impactful stories.

APPENDICES

APPENDIX A

I see a reflection of my own identity and journey in this definition.

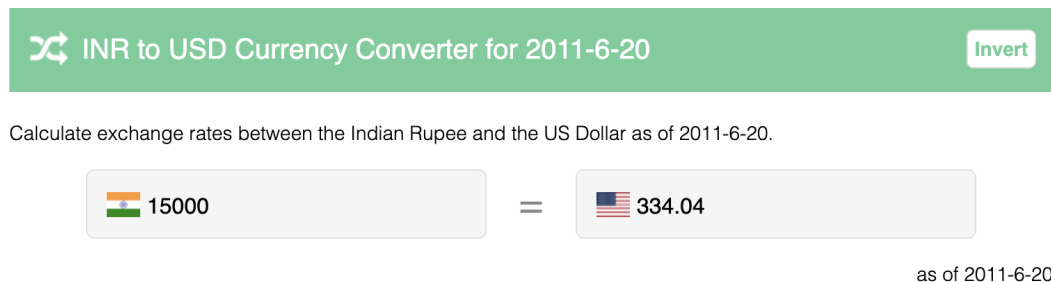
A professional who combines their passion for journalism with their expertise in programming, data analysis, and design to craft innovative, impactful, and memorable stories that shape public discourse, leveraging their expertise in both fields.

I am an interactive journalist. At every stage of my life, people have asked me “Why?” This dissertation represents the culmination of my quest to find more answers to those ‘whys’ and the paths other interactive journalists took to get where they are. When I was eight, someone asked me, “Why do you want to be a journalist when you grow up?” I said, “I want to be like my dad.” My journey began with my first byline at 12. By 15, I was the editor-in-chief of my high school newsletter. The next “why?” came soon after when I wanted to apply to an undergraduate program in journalism. My father refused, asking, “Why do you want to do this?” My answer remained: “I want to be a journalist.” I lost that battle with my father, but his rationale prevailed. He said, “You could either be a master of writing, or you could be a master of some subject. That way, you can bring that wealth of knowledge into journalism.” I agreed and begrudgingly picked my second favorite thing – computer science engineering, because I loved building things and taking them apart, and Lego builds were not enough. Throughout college, I continued writing for the college magazine and became a contributing journalist for two lifestyle magazines.

After graduating from college, I started my career as a developer. It was what I call an “escalator route” for anyone in India with an undergraduate degree in computer science, but the undeniable urge that one of my interviewees aptly termed the “journalism bug” had planted itself

deep inside my brain. I could not shake the feeling that I needed to be part of the action. In less than two years, I quit my job and walked into the offices of The New Indian Express, the second-largest daily newspaper in South India, determined to pursue my love for journalism. When I asked the editor for a job as a reporter, he asked me the same question as my former manager: But why? My answer was the same as always. I think he was impressed that I quit a job that paid me four times as much to earn 15,000 INR. That was June 2011. Figure A. shows the INR to USD conversion rate of my salary from my first journalism job.

Figure A: The Indian Rupees to US Dollar conversion when I became a journalist.



I got the job and became a city beat reporter. I chased stories that my editor told me to cover during the day, and at night I helped with editing and making news pages for print on Adobe InDesign, but something felt missing. I realized I needed formal education to be a better reporter, so I decided to apply to graduate school. I faced more whys. The Columbia University - Graduate School of Journalism admissions committee asked me, “Why journalism?” I remembered the time I reached out to the then Managing Editor of The Washington Post, Raju Narisetti, for his advice about this switch, and his response (in a LinkedIn message) was: “Given your background in computer science and the growing importance of journalist developers, I highly recommend you consider building up that expertise. That is where the jobs will be in the future in Western journalism.” (LinkedIn message dated July 25, 2011) – I told the graduate

admissions committee that I wanted to “marry my two favorite things – journalism and computer science – and advance journalism as we know it.” I must have said the right thing, or perhaps it was just the right time. It was 2012, and I was in!

After journalism school, I became a technology and startup reporter and quickly realized the state of more traditional journalism newsrooms. I watched as the “star tech reporter” in an Indian newsroom used a phone calculator to calculate yearly earnings from an Excel sheet for a pie chart the graphics desk would build. I asked him why he was using a calculator when he had Excel open. I must have seemed like a know-it-all, but I showed him the summation button and also how to create the chart using the same software. He was thrilled but too proud to admit it, saying, “At least you are good at something!” It was true; I had fewer inside sources, my stories were heavily edited, and I could not churn out breaking news stories daily. The news cycle was relentless, like trying to put on shoes while sprinting from one event to the next in a never-ending 6-day cycle. I may not have been the best traditional journalist, but I was “good at something” – visualizing and analyzing data to uncover patterns and trends. I was a good interactive journalist, and newsrooms needed people like me. I used those skills to add features to my stories throughout my journalism career, and somewhere in that time, I realized I needed to use this “weird” and unique set of skills to teach the next generations things that would equip them to prepare for all the coming changes, just as Narisetti had predicted in 2011. That was the answer to my final “why” – applying for a Ph.D. in 2017.

Driven by curiosity about the shared experiences and unique paths that led other interactive journalists like me into this field, I embarked on a journey through this dissertation to understand the stories of those who faced countless whys? along the way and persevered in shaping the industry.

APPENDIX B

The following is the complete list of individuals interviewed for this dissertation research.

Name	Organization	Country
Adrián Blanco Ramos	The Washington Post	US
Ændra Rininsland	Financial Times	UK
Agnel Philip	ProPublica	US
Alessandro Marazzi Sassoon	Freelancer	US
Alex Lim	Australian Broadcasting Corporation (ABC)	New Zealand
Bruno Fonseca	Agência Pública de Jornalismo Investigativo	Brazil
Christopher Udemans	Bloomberg News	South Africa
Edit Gyenge	Freelancer	Romania
Ellis Simani	ProPublica	US
Ferran Morales	Mundo Deportivo	Spain
Isao Matsunami	Freelancer	Japan
Justina (Tina George) Asishan	The Nation Newspaper	Nigeria
Laura Aragó	The Straits Times	Spain
Luiz Toledo	Freelancer	Brazil
Manas Sharma	Defog.ai	India
Paul Schreiber	Tech Matters	US
Rachael Dottle	Bloomberg News	US
Rahul Mukherjee	Axios	US
Rebecca Pazos	The Straits Times	Singapore
Shirsho Dasgupta	Miami Herald	US
Sondre Ulvund Solstad	The Economist	UK
Stephanie Adeline	The Straits Times	Singapore
Weihua Li	The Marshall Project	US
Youyou Zhou	The Washington Post	US

BIBLIOGRAPHY

Anderson, C. W. (2013). Towards a sociology of computational and data journalism. *Sociology*, 2(7), 1-22.

Anderson, C. W., & Caswell, D. (2019). Computational thinking across the curricula. *Journalism & Mass Communication Educator*, 74(4), 447-459.

Ananny, M., & Crawford, K. (2015). A liminal press: Situating news app designers within a field of negotiated journalism ethics. *Digital Journalism*, 3(2), 192-208.

Appelgren, E., & Lindén, C. G. (2020). Data journalism as a service: Digital native data journalism expertise and product development. *Media and Communication*, 8(2), 62-72.

Appelgren, E., & Nygren, G. (2014). Data journalism in Sweden: Introducing new methods and genres of journalism into 'old' organizations. *Digital Journalism*, 2(3), 394-405.

Archibald, M. M., Ambagtsheer, R. C., Casey, M. G., & Lawless, M. (2019). Using Zoom video conferencing for qualitative data collection: Perceptions and experiences of researchers and participants. *International Journal of Qualitative Methods*, 18, 1-8.

Arksey, H., & Knight, P. T. (1999). Interviewing for social scientists: An introductory resource with examples.

Ausserhofer, J., Gutounig, R., Oppermann, M., Matiassek, S., & Goldgruber, E. (2020). The datafication of data journalism scholarship: Focal points, methods, and research ethics in computational journalism. *Digital Journalism*, 8(7), 895-918.

Baack, S. (2018). Practically engaged: The entanglements between data journalism and civic tech. *Digital Journalism*, 6(6), 673-692.

Benson, R. (2006). News media as a "journalistic field": What Bourdieu adds to new institutionalism, and vice versa. *Political Communication*, 23(2), 187-202.

Berret, C., & Phillips, C. (2016). Teaching data and computational journalism. *Columbia School of Journalism*.

Borges-Rey, E. (2016). Unravelling data journalism: A study of data journalism practice in British newsrooms. *Journalism Practice*, 10(7), 833-843.

Borges-Rey, E. (2021). 22. Journalism With Machines? From Computational Thinking to Distributed Cognition. *Towards a Critical Data Practice*, 147.

Bourdieu, P. (1986). The force of law: Toward a sociology of the juridical field. *Hastings LJ*, 38, 805.

Bourdieu, P. (1993). *The field of cultural production: Essays on art and literature*. Columbia University Press.

Boyles, J. L., & Meyer, E. (2016). Letting the data speak: Role perceptions of data journalists in fostering democratic conversation. *Digital Journalism*, 4(7), 944-954.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77-101.

Brinkmann, S., & Kvale, S. (2015). Interviews: Learning the craft of qualitative research interviewing. Sage publications.

Carlson, M. (2018). The robotic reporter: Automated journalism and the redefinition of labor, compositional forms, and journalistic authority. In Journalism in an Era of Big Data (pp. 108-123). Routledge.

Carlson, M., & Lewis, S. C. (Eds.). (2015). Boundaries of journalism: Professionalism, practices and participation. Routledge.

Carcary, M. (2011). Evidence analysis using CAQDAS: Insights from a qualitative researcher. Electronic Journal of Business Research Methods, 9(1), pp10-24.

Cairo, A. (2012). The Functional Art: An introduction to information graphics and visualization. New Riders.

Caswell, D., & Dörr, K. (2018). Automated Journalism 2.0: Event-driven narratives: From simple descriptions to real stories. Journalism practice, 12(4), 477-496.

Charmaz, K. (2014). Constructing grounded theory (2nd ed.). Sage.

Chua, S., & Duffy, A. (2019). Friend, foe or frenemy? Traditional journalism actors' changing attitudes towards peripheral players and their innovations. Media and communication.

Coddington, M. (2015). Clarifying journalism's quantitative turn: A typology for evaluating data journalism, computational journalism, and computer-assisted reporting. Digital journalism, 3(3), 331-348.

Cohen, S., Hamilton, J. T., & Turner, F. (2011). Computational journalism. *Communications of the ACM*, 54(10), 66-71.

Cohen, N. (2011). It's tracking your every move, and you may not even know. *The New York Times*, A1-L.

Columbia Journalism Review. (2023, May 15). It's getting more difficult for foreign journalists to work in the US. *Columbia Journalism Review*. <https://www.cjr.org/analysis/journalist-visa.php>

Corbin, J., & Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage publications.

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Danzon-Chambaud, S., & Cornia, A. (2023). Changing or reinforcing the “rules of the game”: A field theory perspective on the impacts of automated journalism on media practitioners. *Journalism practice*, 17(2), 174-188.

De Maeyer, J., Libert, M., Domingo, D., Heinderyckx, F., & Le Cam, F. (2018). Waiting for data journalism: A qualitative assessment of the anecdotal take-up of data journalism in French-speaking Belgium. In *Journalism in an Era of Big Data* (pp. 124-138). Routledge.

Diakopoulos, N. (2016). Computational journalism and the emergence of news platforms. In *The Routledge companion to digital journalism studies* (pp. 176-184). Routledge.

Ekdale, B., Tully, M., Harmsen, S., & Singer, J. B. (2015). Newswork within a culture of job insecurity: Producing news amidst organizational and industry uncertainty. *Journalism Practice*, 9(3), 383-398.

Fink, K., & Anderson, C. W. (2015). Data Journalism in the United States: Beyond the “usual suspects”. *Journalism studies*, 16(4), 467-481.

Frenette, A. (2015). The Internship Divide: The Promise and Challenges of Internships in the Arts. Special Report. Strategic National Arts Alumni Project.

Glaser, B., & Strauss, A. (2017). *Discovery of grounded theory: Strategies for qualitative research*. Routledge.

Gravengaard, G., & Rimestad, L. (2012). Elimination of ideas and professional socialisation: Lessons learned at newsroom meetings. *Journalism Practice*, 6(4), 465-481.

Greenwood, K., & Reinardy, S. (2011). Self-trained and self motivated: Newspaper photojournalists strive for quality during technological challenges. *Visual Communication Quarterly*, 18(3), 155-166.

Gubrium, J. F., Holstein, J. A., Marvasti, A. B., & McKinney, K. D. (Eds.). (2012). *The SAGE handbook of interview research: The complexity of the craft*. Sage Publications.

Gynnild, A. (2014). Journalism innovation leads to innovation journalism: The impact of computational exploration on changing mindsets. *Journalism*, 15(6), 713-730.

d'Haenens, L., Lo, W. H., & Moore, M. Innovation in journalism. *SUCCESS AND FAILURE*, 337.

Hannaford, L. (2015). Computational journalism in the UK newsroom. *Journalism education*, 4.

Hanusch, F., & Tandoc Jr, E. C. (2019). Comments, analytics, and social media: The impact of audience feedback on journalists' market orientation. *Journalism*, 20(6), 695-713.

Heravi, B. R. (2017). Teaching data journalism. Mair, J., Keeble, RL, Lucero, M.(eds.). *Data Journalism: Past, Present and Future*.

Hermida, A. (2013). # Journalism: Reconfiguring journalism research about Twitter, one tweet at a time. *Digital journalism*, 1(3), 295-313.

Hermida, A., & Young, M. L. (2017). Finding the data unicorn: A hierarchy of hybridity in data and computational journalism. *Digital Journalism*, 5(2), 159-176.

Hermida, A., & Young, M. L. (2019). *Data journalism and the regeneration of news*. Routledge.

Hepp, A., & Loosen, W. (2021). Pioneer journalism: Conceptualizing the role of pioneer journalists and pioneer communities in the organizational re-figuration of journalism. *Journalism*, 22(3), 577-595.

Houston, B., & Horvit, M. (2020). *Investigative Reporters Handbook*. Bedford/Saint Martin's.

Hultén, G., & Edwardsson, M. P. (2018). Storylab lessons: A collaborative project between courses in journalism and media technology. *Nordicom Review*, 39(1), 3-17.

- Hullman, J., & Diakopoulos, N. (2011). Visualization rhetoric: Framing effects in narrative visualization. *IEEE transactions on visualization and computer graphics*, 17(12), 2231-2240.
- Kosterich, A., & Weber, M. S. (2019). Careers in modern professional journalism: A case study of NYC journalist network histories 2011–2015. *Journalism Practice*, 13(8), 982-987.
- Lewis, S. C., & Usher, N. (2017). Code, collaboration, and the future of journalism: A case study of the Hacks/Hackers global network. In *The Future of Journalism: In an Age of Digital Media and Economic Uncertainty* (pp. 129-139). Routledge.
- Lewis, S. C., & Usher, N. (2016). Trading zones, boundary objects, and the pursuit of news innovation: A case study of journalists and programmers. *Convergence*, 22(5), 543-560.
- Lewis, S. C. (2015). Journalism in an era of big data: Cases, concepts, and critiques. *Digital journalism*, 3(3), 321-330.
- Lewis, S. C., & Westlund, O. (2015). Actors, actants, audiences, and activities in cross-media news work: A matrix and a research agenda. *Digital journalism*, 3(1), 19-37.
- Lindlof, T. R., & Taylor, B. C. (2017). *Qualitative communication research methods*. Sage publications.
- Loosen, W., Reimer, J., & De Silva-Schmidt, F. (2020). Data-driven reporting: An on-going (r) evolution? An analysis of projects nominated for the Data Journalism Awards 2013–2016. *Journalism*, 21(9), 1246-1263.

Lowrey, W., & Daniels, G. L. (2017). Assessing a 10-year experiment in community journalism education. *Journalism & Mass Communication Quarterly*, 94(1), 335-354.

de-Lima-Santos, M. F. (2022). ProPublica's data journalism: how multidisciplinary teams and hybrid profiles create impactful data stories. *Media and Communication*, 10(1), 5-15.

Merryman, R. (2018). Integrating industry collaboration into the journalism curriculum. *Journalism Education*, 6(3), 62-71.

Møller Hartley, J. (2013). The online journalist between ideals and audiences: Towards a (more) audience-driven and source-detached journalism?. *Journalism Practice*, 7(5), 572-587.

Moreira, S. V., & Alonso, M. O. (2018). JOURNALISTS IN NEWSROOMS: Professional roles, influences, and changes to journalism. *Brazilian Journalism Research*, 14(2), 304.

Müller, N. C., & Wiik, J. (2023). From gatekeeper to gate-opener: Open-source spaces in investigative journalism. *Journalism Practice*, 17(2), 189-208.

Opgenhaffen, M., & d'Haenens, L. (2015). Managing social media use: Whither social media guidelines in news organizations?. *International Journal on Media Management*, 17(4), 201-216.

Parasie, S. (2011). 'Hacker' journalism-A new utopia for the press?.

Parasie, S., & Dagiral, E. (2013). Data-driven journalism and the public good: "Computer-assisted-reporters" and "programmer-journalists" in Chicago. *New media & society*, 15(6), 853-871.

Parks, P. (2015). A collaborative approach to experiential learning in university newswriting and editing classes: A case study. *Journalism & Mass Communication Educator*, 70(2), 125-140.

Perlin, R. (2012). *Intern nation: How to earn nothing and learn little in the brave new economy*. Verso Books.

Perreault, G. P. (2023). Finding Joy as Journalists: Motivations for Newswork. In *Happiness in Journalism* (pp. 25-32). Routledge.

Reinardy, S. (2011). Newspaper journalism in crisis: Burnout on the rise, eroding young journalists' career commitment. *Journalism*, 12(1), 33-50.

Royal, C. (2012). The journalist as programmer: A case study of the New York Times interactive news technology department. *ISOJ Journal*, 2(1), 5-22.

Royal, C., & Kiesow, D. (2021). From boundary to bridge and beyond: the path to professionalization of product roles in journalism. *Journalism Studies*, 22(11), 1546-1565.

Rubin, H. J., & Rubin, I. S. (2011). *Qualitative interviewing: The art of hearing data*. sage.

Ruotsalainen, J. (2018). Scanning the shape of journalism—Emerging trends, changing culture?. *Futures*, 104, 14-24.

Salamon, E. (2015). (De) valuing intern labour: Journalism internship pay rates and collective representation in Canada. *tripleC: Communication, Capitalism & Critique. Open Access Journal for a Global Sustainable Information Society*, 13(2), 438-458.

Seidman, I. (2006). *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. Teachers college press.

Siitonen, M., & Aira, A. (2019). Technology-Mediated Communication in the Workplace. In *Workplace Communication* (pp. 96-109). Routledge.

Splendore, S., & Brambilla, M. (2021). The hybrid journalism that we do not recognize (anymore). *Journalism and Media*, 2(1), 51-61.

Stalph, F. (2018). Classifying Data Journalism: A content analysis of daily data-driven stories. *Journalism practice*, 12(10), 1332-1350.

Stalph, F. (2020). Evolving data teams: Tensions between organisational structure and professional subculture. *Big Data & Society*, 7(1), 2053951720919964.

Stalph, F., & Borges-Rey, E. (2018). Data journalism sustainability: An outlook on the future of data-driven reporting. *Digital journalism*, 6(8), 1078-1089.

Stringer, C. (2016). The origin and evolution of Homo sapiens. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 371(1698), 20150237.

Strömbäck, J. (2009). Selective professionalisation of political campaigning: A test of the party-centred theory of professionalised campaigning in the context of the 2006 Swedish election. *Political studies*, 57(1), 95-116.

Tabary, C., Provost, A. M., & Trottier, A. (2016). Data journalism's actors, practices and skills: A case study from Quebec. *Journalism*, 17(1), 66-84.

Tandoc Jr, E. C., & Oh, S. K. (2017). Small departures, big continuities? Norms, values, and routines in The Guardian's big data journalism. *Journalism studies*, 18(8), 997-1015.

Usher, N. (2016). *Interactive journalism: Hackers, data, and code*. University of Illinois Press.

Usher, N. (2018). Breaking news production processes in US metropolitan newspapers: Immediacy and journalistic authority. *Journalism*, 19(1), 21-36.

Uskali, T. I., & Kuutti, H. (2015). Models and streams of data journalism. *The journal of media innovations*, 2(1), 77-88.

Vos, T. P., & Craft, S. (2017). The discursive construction of journalistic transparency. *Journalism studies*, 18(12), 1505-1522.

Voakes, P. S. (1999). Civic duties: Newspaper journalists' views on public journalism. *Journalism & Mass Communication Quarterly*, 76(4), 756-774.

Wacquant, L. (2018). Bourdieu comes to town: Pertinence, principles, applications. *International journal of urban and regional research*, 42(1), 90-105.

Wahl-Jorgensen, K. (2016). Emotion and journalism. *The SAGE handbook of digital journalism*, 128-143.

Weaver, D. H., & Willnat, L. (Eds.). (2012). *The global journalist in the 21st century* (pp. 1-10). New York: Routledge.

Weber, M. S., & Kosterich, A. (2018). Coding the News: The role of computer code in filtering and distributing news. *Digital Journalism*, 6(3), 310-329.

Weber, W., & Rall, H. (2012, July). Data visualization in online journalism and its implications for the production process. In 2012 16th International Conference on Information Visualisation (pp. 349-356). IEEE.

Wenger, E. (1999). *Communities of practice: Learning, meaning, and identity*. Cambridge university press.

Westlund, O., & Krumsvik, A. H. (2014). Perceptions of Intra-Organizational Collaboration and Media Workers Interests in Media Innovations.

Witschge, T., & Nygren, G. (2009). Journalistic work: A profession under pressure?. *Journal of media business studies*, 6(1), 37-59.

Wolz, U., Stone, M., Pearson, K., Pulimood, S. M., & Switzer, M. (2011). Computational thinking and expository writing in the middle school. *ACM Transactions on Computing Education (TOCE)*, 11(2), 1-22.

Wu, S., Tandoc Jr, E. C., & Salmon, C. T. (2019). When journalism and automation intersect: Assessing the influence of the technological field on contemporary newsrooms. *Journalism practice*, 13(10), 1238-1254.

Young, M. L., Hermida, A., & Fulda, J. (2018). What makes for great data journalism? A content analysis of data journalism awards finalists 2012–2015. *Journalism practice*, 12(1), 115-135.

Zamith, R., & Braun, J. A. (2019). Technology and journalism. *The international encyclopedia of journalism studies*, 1-7.