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The Blurred Line Between Science Communication and Advocacy:

Exploring the Influence of Researcher Identity in Science Communication

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BPsych

Thesis submitted in fulfilment of the requirements for the degree of

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For Anne.

Forever grateful to have known you.

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Statement of the Use of Generative AI

Generative AI technology was not used in the preparation of any part of this thesis.

Abstract

Bridging the gap between complex scientific research and societal needs, science communication has the potential to enhance engagement, promote trust in scientific institutions, and facilitate the translation of knowledge into practical applications. However, what is considered '*effective'* science communication is not a clearly understood or defined notion within the literature or indeed within the scientific community. For instance, there are times when science communication may cross into advocacy, which may be seen as appropriate communication by some scientific groups, while similarly considered by others to be outside the purview of researchers. While advocacy may be considered an effective form of science communication, at times advocacy engagement may be misconstrued, misunderstood or distorted as supporting a particular narrative or political opinion, leading to potentially negative outcomes for the researcher or the perception of science more broadly.

This thesis aimed to explore the complex interplay between professional identity, science communication and advocacy among researchers, to understand why some researchers choose to engage in advocacy-type communication while others do not. This research was addressed by exploring how researchers perceive their professional roles and identity in relation to science communication and advocacy and to develop an understanding of how researcher interpret the interaction between science communication and advocacy, through the lens of their professional identities. This thesis aims were exploratory in nature and adopted a qualitative approach to address the thesis aims given the limited literature examining researchers' identities and roles in the context of science communication and advocacy. Drawing on in-depth, semi-structured interviews, reflexive thematic analysis within an interpretive phenomenological analysis framework was applied to explore the lived experiences of 33 researchers (M age = 49.9, *SD* = 9.6). A total of 15 females and 18 males

within the STEM (n = 20), public health (n = 7) and social science (n = 6) disciplines were interviewed.

The findings indicate that participants consistently expressed a professional identity as researchers in ways that align with Western societal norms, suggesting the presence of a well-defined and widely recognised identity within the scientific community. While this identity remained stable across individuals and career stages, variations emerged in researchers' perceptions of their roles as science communicators in society. Participant responses underscored the multifaceted nature of researchers' involvement in science communication, revealing diverse and, at times, conflicting perspectives on their roles, responsibilities and motivations—particularly in relation to advocacy-based communication. Additionally, participants identified key facilitators and barriers that influence their engagement in advocacy-oriented communication, as well as the potential consequences of these communication choices.

The findings of this study have several important implications. The results support the development of a new communication model, conceptualised as a continuum between science communication and advocacy. This model delineates distinctions between formal and informal science communication, as well as between science advocacy and personal advocacy. Moreover, the findings illustrate that researchers position themselves along this continuum based on their professional identities, selecting a stance that aligns with their perceived roles and values. Additionally, these findings highlight the complementary nature of social identity theory (SIT) and self-categorization theory (SCT), demonstrating how the integration of both frameworks can enhance our understanding of the development of researchers' professional identities.

Effective science communication is essential for societal progress, yet ineffective engagement can have profound consequences. This research underscores the complexity of

this issue, highlighting that failing to consider researchers' perspectives risks eroding public trust, undermining the credibility of scientific findings, and negatively impacting researchers' wellbeing. By contributing to both theoretical and practical understandings of researchers' evolving professional identities, this study offers new insights into how researchers perceive their roles and responsibilities within an increasingly complex communicative landscape. Additionally, it provides practical recommendations for institutions and policymakers to better support researchers in navigating these challenges, ensuring that science communication remains a vital bridge between the scientific community and society.

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List of Abbreviations

AAAS	American Association for the Advancement of Science
AusSMC	Australian Science Media Centre
GDP	Gross domestic product
HDR	Higher degree research
IPA	Interpretive phenomenological analysis
NHMRC	National Health and Medical Research Council
PBL	Problem-based learning
PROGRESS	PROmoting Geoscience Research, Education, and SuccesS
R&D	Research and development
SCT	Self-Categorisation theory
SEM	Structural equation modelling
SIA	Social identity approach
SIT	Social identity theory
STEM	Science, technology, engineering and mathematics
US	United States (of America)

General Introduction

Science communication is an embedded function of the scientific method and has always been a critical component for the progression of science throughout history. The results of scientific discoveries are visible throughout the world; for example, they help shape policy initiatives, create new industries and provide better healthcare. Indeed, science has become increasingly entwined with national and international political issues (Van Boven et al., 2018), with the communication of scientific information playing an increasingly important role in informing government policy (Anderson & Betsill, 2010; Blockstein, 2002).

Historically, the communication of science by researchers has focused mainly on communication with other researchers and was generally focused on producing journal articles (Weigold, 2001). However, as the relevance and importance of science for everyday life have become front and centre of our society, researchers are increasingly pressured to take responsibility for sharing their discoveries with society (Bucchi, 2013). Consequently, researchers are increasingly feeling the pressure to communicate their science in novel ways that extend far beyond journal articles (Bednarek & Tseng, 2022; Murunga et al., 2024). The pressure on researchers is compounded by politicians who use scientific findings as evidence for their policy decisions within the public sphere (Pielke, 2007). There are strong and valid arguments for researchers themselves to step forward and lead this science communication as often the best people to communicate science are the researchers themselves (Chambers et al., 2022; Mach et al., 2020). Researchers are thought to be the most appropriate communicators as they are the ones who conduct the research, understand the complexities of the findings and are in the best position to explain the nuance of their science.

When considering how science is communicated within modern society, there is generally still an emphasis on science communication in its historical sense (communication between researchers through journal articles). However, it is increasingly evident that there is

a shift towards other forms of communication, such as advocacy. In fact, to achieve the best outcomes for society through the use of scientific findings, science communication is, in some circumstances, framed in advocacy terms, and researchers are more frequently becoming engaged in advocacy roles (Côté & Darling, 2018). Despite the recognised value and importance of science communication and/or advocacy for the dissemination of science and the increasing pressure on researchers to be the ones to communicate publicly, many researchers choose not to engage in science communication, and fewer choose to engage in advocacy-type communication.

The communication of scientific information has become an important research area, with researchers examining topics such as the effectiveness of science documentaries in producing intended behavioural changes (Yeo et al., 2018), opinions relating to science communication (Treise & Weigold, 2002) and attitudes towards science (Sturgis & Allum, 2004). The majority of this research has focused on the best ways to do science communication (Bowater & Yeoman, 2012; Bruine de Bruin & Bostrom, 2013; Fischhoff, 2019; Kuehne et al., 2014), ways to increase science communication engagement by researchers (Besley et al., 2015; Bray et al., 2012; Cooke et al., 2017; Mercer-Mapstone & Kuchel, 2017), the impact science communication has on the public (Akin & Scheufele, 2017; Bauer, 2008; Gustafson & Rice, 2020) and public trust in science (Intemann, 2023; Rosman et al., 2022; Weingart & Guenther, 2016; Wintterlin et al., 2022). A growing but still limited body of research has begun to shift its focus toward scientists themselves, exploring factors such as: scientists' motives in science communication (Entradas et al., 2019), how scientists interact with journalists (Dudo, 2015) and challenges scientists face when engaging with others (Lorenzoni, et al., 2007). However, while some studies have identified potential factors—such as time and funding—that may influence scientists' decisions to engage in science communication (Cologna et al., 2021; Murumga et al., 2024), this research remains

largely practical in nature, emphasising the logistical and pragmatic aspects of participation rather than the underlying psychological drivers.

While these earlier studies have advanced our broader understanding of science communication and begun to shift attention toward the communicators themselves, research that examines engagement in science communication through the lens of psychological factors remains a crucial area of inquiry. Examining the cognitive, motivational, and emotional drivers that shape how scientists and science communicators engage with diverse audiences can provide valuable insights into the effectiveness of communication strategies. By examining the psychological mechanisms underlying science communication—such as the role of identity in shaping communication styles—researchers can develop more targeted strategies to foster meaningful dialogue between scientists and the public. Additionally, this understanding can help create psychologically safe environments that encourage researchers to engage in effective science communication. This perspective not only strengthens theoretical frameworks in science communication but also has practical implications for enhancing public trust, combating misinformation, improving scientific literacy, and safeguarding the health and well-being of those who communicate science.

Before moving further along in this discussion, it is necessary to explain the differences between science communication and advocacy and how these will be differentiated in this thesis. Science communication encompasses a broad spectrum of activities aimed at bridging the gap between science and society (Broks et al., 2020). Key objectives of science communication include educating lay audiences about scientific discoveries, enhancing public awareness and interest in scientific endeavours, influencing attitudes and behaviours, informing public policy decisions and fostering engagement with diverse communities to address societal challenges (Broks et al., 2020). The term ‘science communication’ typically refers to interactions where the audience lacks expertise in the

specific scientific domain being discussed (commonly referred to as outreach). However, some scholars also classify expert-to-expert communication (termed ‘in reach’, such as scholarly publications) as a form of science communication (Illingworth & Allen, 2016). Advocacy is considered a specific form of public communication, with a researcher becoming an advocate when they move beyond reporting, clarifying, interpreting and explaining into the realm of providing recommendations and advice (Steneck, 2011). This distinction between the two is important because exploring the differences between science communication and scientific advocacy enables researchers to better navigate their roles and responsibilities as researchers. A clearer understanding of their role within society enables researchers to uphold scientific integrity, enhance public comprehension of science, and contribute meaningfully to societal discourse and decision-making processes (Turnhout et al., 2013).

Researching this area is imperative because it explains the distinctions between science communication and advocacy, thereby clarifying researchers’ intentions in their interactions with the public. This differentiation is critical for upholding scientific integrity, enabling researchers to navigate ethical boundaries between factual communication and advocacy efforts. Moreover, understanding these distinctions may empower researchers to deploy suitable engagement strategies aligned with their communication objectives. The clarity with which researchers delineate between communication and advocacy influences public perceptions of their credibility. Furthermore, this understanding is particularly relevant for researchers engaged in policy discourse, facilitating informed contributions to decision-making processes (Pielke, 2007).

The current research focuses on understanding researchers themselves by exploring the psychological mechanisms underlying science communication—such as the role of identity in shaping communication styles, researchers’ self-perception, and their

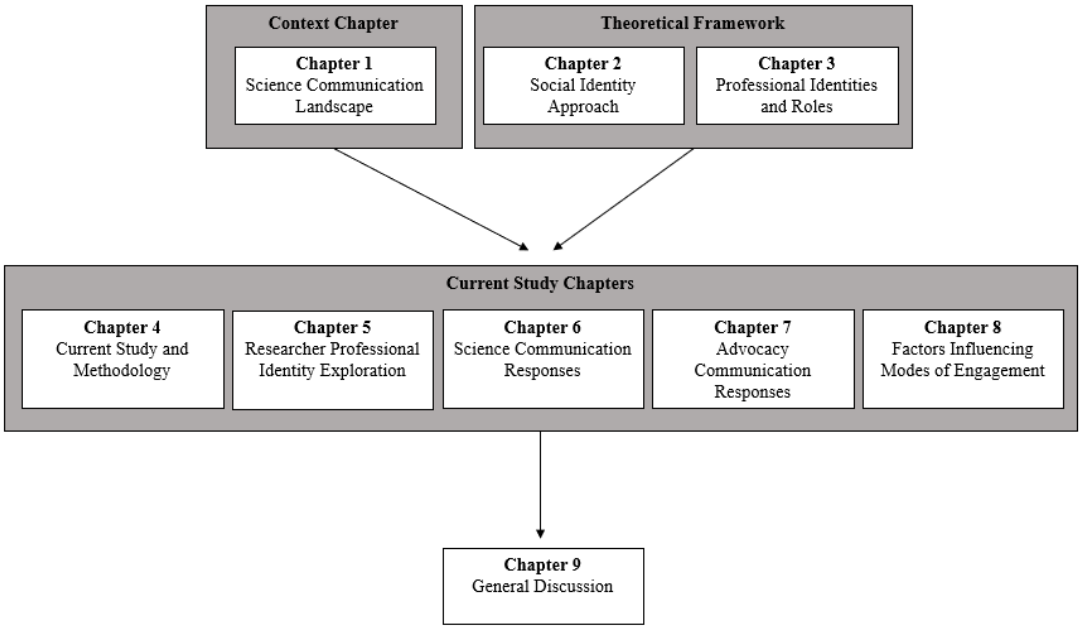
conceptualisation of the distinctions between advocacy and science communication. With science being instrumental in the development of society (Archer et al., 2010), its presence in almost all aspects of life links a researcher's identity as a researcher with their understanding of science. Their belief system and view of the world are shaped by the scientific method, in that researchers stress the pursuit of the truth through all aspects of their lives (Ecklund & Long, 2011), and seem to embody these elements of science as part of their identity. It is important to note that multiple factors shape identity formation and that the social structures individuals find themselves in, such as professional and educational settings, can affect this formation (Stryker & Burke, 2000). One lens through which to explore researchers' engagement with science communication is through their professional identity as a researcher, specifically that of their professional identity, and the associated social norms and roles that align with this identity. These norms and roles shape researchers' behaviour and, in turn, influence their participation in science communication. Given that the professional identities of researchers are regarded, psychologically, as social identities, a social identity approach (SIA) will serve as the theoretical framework for this research. Social identity theory (SIT) and self-categorization theory (SCT) will be applied within this framework to examine researchers' identities and roles in relation to science communication.

The conceptual framework for the thesis is shown in Figure 1. The first chapter presents a discussion on science communication within an Australian context and an overview of how researchers use and understand advocacy in the context of communicating science. The second chapter presents the SIA as a theoretical framework to understand this project. This chapter explores SIT and SCT, explaining the nuances of the theory and justifying its usage in the current context. Chapter 3 explores professional identities as an additional conceptual framework to understand the current research findings. In particular, the chapter explores the professional identity literature, highlighting the importance and

interplay between professional identities and roles, linking with SIA to demonstrate the relevance of this perspective to the understanding of this project. These first three chapters form the foundation that informs this thesis's study. The study investigated researchers understanding and engagement in science communication and advocacy, focusing on a North Queensland sample. The study also tested the appropriateness of SIA in understanding the differences displayed by different researchers in their engagement with science communication and advocacy. The study's rationale, aims, research questions, methodology, results and discussions are presented in Chapters 4–8. Chapter 9 concludes the thesis by presenting the project's overall theoretical and practical implications, recommendations, future directions and limitations.

Figure 0.1

Conceptual Diagram of Thesis



Operationalisation of Terms

This thesis will adopt the term 'researcher' in lieu of 'scientist.' This choice reflects the intention to encompass professionals from diverse disciplinary backgrounds involved in

research activities, aiming to avoid a reductionist perspective and aligning with established literature (Hangel & Schmidt-Pfister, 2017). While individuals engaged in research generally identify themselves as researchers, not all necessarily identify as scientists. Therefore, for this study, a researcher will be operationally defined as an individual who systematically collects and utilises research and evidence, formulates hypotheses, and tests them to foster collective understanding and knowledge (Science Council, 2019). Given this thesis' specific focus on understanding the researcher's conceptualisation of science communication and the place that advocacy holds within science communication, advocates will not be explicitly targeted. Instead, this project will concentrate on researchers who self-identify as researchers.

Chapter 1: Science Communication Landscape

Science is important for society because it drives progress, expands our understanding of the world and enables us to tackle large-scale science-related challenges. It provides an evidence base for shaping policies, innovation practices and driving advancements that benefit society's wellbeing and progress (Burns et al., 2003; Turnhout et al., 2013; Weigold, 2001). There have been challenges in recent years with the replicability crisis, funding and resource constraints and with the rise of social media the spread of misinformation and disinformation. This has posed challenges to the public trust in science, the integrity of science, the reliability of scientific findings and the acceptance of evidence-based information for decision-making (Bao et al., 2023). Consequently, the importance of communicating science has never been this apparent. Exploring the distinction between science communication and scientific advocacy will enable researchers to navigate their roles responsibly, uphold scientific integrity, enhance public understanding of science, and contribute meaningfully to societal discussions and decision-making processes. This area of research is imperative because understanding the differences between science communication and advocacy helps clarify the intentions behind researchers' interactions with the public and is crucial for maintaining scientific integrity. Furthermore, exploring the differences between science communication and advocacy allows researchers to employ appropriate engagement strategies based on their specific communication goals. This has the flow-on effect of impacting the public's perception of science and researchers' credibility in the public's eye, and it can affect researchers' involvement in policy-related discussions.

1.1 Acknowledgement of Western Perspectives

It is important to acknowledge that this thesis is rooted in a predominantly Western understanding of 'science' and 'science communication'. The frameworks, methodologies and conceptualisations discussed throughout this work largely reflect the Western scientific

tradition, which emphasises empiricism, objectivity and the systematic pursuit of knowledge through experimentation and observation (Popper, 2005). As understood in this context, science is not a universal construct but one shaped by historical, cultural and philosophical developments in Western societies (Nowotny et al., 2001). Many non-Western cultures possess rich traditions of knowledge that are often excluded from or marginalised within mainstream scientific discourse. Indigenous knowledge systems, for example, offer holistic, relational and often place-based understandings of the natural world, which differ fundamentally from Western science's compartmentalised and reductionist tendencies (Ban et al., 2018). These knowledge systems are not simply alternative perspectives; they represent complex, deeply contextualised ways of knowing that are integral to the lived experiences of many communities.

This thesis, therefore, operates within the confines of a Western scientific paradigm and does not fully engage with non-Western epistemologies. While this approach allows for an in-depth exploration of science communication as understood in Western academic and professional settings, it also inherently limits the scope of the inquiry. The exclusion of non-Western perspectives should not be seen as a dismissal of their importance but rather as a necessary delimitation of the research focus. Further research that incorporates diverse epistemologies would offer a more comprehensive understanding of science communication and advocacy in a global context. In acknowledging these limitations, this thesis recognises the need for ongoing dialogue between Western and non-Western perspectives, particularly as the field of science communication continues to evolve in an increasingly interconnected world. A more inclusive approach integrating multiple ways of knowing would enrich the field and better reflect the diversity of experiences, values and understandings shaping the global scientific community.

1.2 Science Communication

The engagement by researchers in science communication is a vital component to the continual development of society. There is a plethora of information regarding the effectiveness of science communicators (Burns et al., 2003; Weigold, 2001; Yeo et al., 2018) and the public's understanding of science (De Boer et al., 2005; Gregory & Lock, 2008). Consequently, there is an expanding understanding of the importance of science communication in practice and research (Burns et al., 2003).

1.2.1 Defining Science Communication

The term 'science communication' encompasses various approaches to sharing scientific knowledge, ranging from one-way dissemination by researchers to interactive public engagement, where researchers and the public interact through 'public engagement' (Bultitude, 2011). Burns et al. (2003, p. 183) provide a broader definition of science communication as 'the use of appropriate skills, media, activities, and dialogue to produce one or more of the following personal responses to science: Awareness, Enjoyment, Interest, Opinion-forming, and Understanding'. Generally speaking, the literature and research on science communication have shifted towards this broader interpretation, incorporating all science engagement activities (Metcalfe, 2019). There are three dominant models of science communication: the deficit model, the dialogue model and the participatory model (Metcalfe, 2019; Nisbet & Scheufele, 2009; Trench, 2008; Ziman, 1991). These models all describe the relationship between researchers and the public.

The deficit model of science communication conceptualises the dissemination of scientific knowledge as a one-way process from researchers to the public (Durant et al., 1992; Millar & Wynne, 1988; Nisbet & Scheufele, 2009). This model is predicated on the assumption that a lack of scientific knowledge among the public—often referred to as a 'deficit'—necessitates corrective education by researchers and scientific institutions to

improve science literacy (Bucchi, 2004; Irwin, 2006; Joly & Kaufmann, 2008; Nisbet & Scheufele, 2009). Consequently, deficit-based communication primarily serves the scientific community's interests, as it is often employed to raise public awareness of scientific advancements (Palmer & Schibeci, 2014) and garner support for research funding (Durant, 1999). However, by reinforcing a perceived knowledge hierarchy between researchers and the public, this model risks perpetuating researchers' notions of operating within an 'ivory tower' detached from societal concerns. In response to these limitations, there has been a significant shift from deficit-oriented communication (Nisbet & Scheufele, 2009; Ziman, 1991) toward more interactive and participatory approaches. The dialogic model and, in some cases, a distinct participatory model have emerged as alternative frameworks, emphasising two-way engagement between researchers and the public. These models seek to foster more equitable interactions, such as public consultations and collaborative problem-solving initiatives (Horst & Michael, 2011), thereby promoting a more inclusive and reciprocal exchange of knowledge.

The dialogue model of science communication emphasises a reciprocal exchange between researchers and the public, moving beyond unidirectional knowledge transfer to foster meaningful discussion (Metcalfe, 2019). In this model, science communicators engage with the public to explain scientific concepts and actively listen to public concerns, needs, and perceptions regarding science (Wynne, 2006; Zorn et al., 2012). This approach acknowledges that the public can offer valuable insights contributing to scientific progress and policymaking (Irwin, 2021; Joly & Kaufmann, 2008), thereby positioning science communication as a more inclusive and dynamic process.

The participatory model of science communication extends this principle further by positioning the public as equal stakeholders alongside researchers and policymakers. This model conceptualises all groups as having an equivalent role in sharing, reflecting on and

generating scientific knowledge and making decisions about science-related issues that affect society (Joly & Kaufmann, 2008). A defining characteristic of this model is the deliberate shift in power from researchers to the public, with policymakers playing an essential role in the democratisation of science (Metcalfe, 2019). This transition has led to the increased prominence of public engagement activities, such as citizen science initiatives and public forums, which have become central to science communication practices over the past three decades (Gregory & Lock, 2008).

As participatory approaches gain traction, the effective communication of scientific information has become an important area of research. Studies have examined the impact of science communication on behavioural change through media such as science documentaries (Yeo et al., 2018), public perceptions of science communication (Treise & Weigold, 2002), and attitudes toward science more broadly (Sturgis & Allum, 2004). More recently, research has expanded to explore science communication within digital spaces, including network analyses of social media discussions on climate change (Williams et al., 2015), the role of social media as a platform for scientific discourse (Veltri & Atanasova, 2017) and public trust in sources of scientific information about the environment (Brewer & Ley, 2013). However, much of this research has traditionally focused on the content of scientific messages and their reception by the public, with comparatively little attention given to the individuals responsible for communicating these messages—namely, the researchers themselves. Consequently, further investigation is needed to understand the role of researchers in science communication, particularly concerning fostering public trust and maintaining the integrity of science.

1.2.2 Advocacy Within Science Communication

At times, it may be more effective for researchers to engage in scientific advocacy because traditional science communication strategies are less effective than advocacy-type

messaging. For instance, some scientific advocacy can provide recommendations and advice to decision-makers, including using scientific principles to support policies and management decisions (Pool et al., 2017). The engagement of researchers in advocacy-type positions can have several benefits. For instance, the lack of expert input within public debates can lead some researchers to engage in advocacy. Fischhoff (2007) suggests that researchers may turn towards advocacy positions after determining that the science would not receive a fair hearing without their input. For example, environmental policies benefit from researchers engaging in science-based advocacy by identifying relevant scientific information, and the implementation of policies is consistent with the best available science (Cockrell et al., 2018; Lövbrand, 2007; Meyer et al., 2010). Researchers have experience with the scientific process and expert knowledge, which could be used to help guide decisions on many pressing issues, such as climate change (Cockrell et al., 2018). While this is specific to both science communication and advocacy, when researchers engage in scientific advocacy, they more often provide specific recommendations about what should be done based on scientific evidence but with a specific science focus in mind. Research undertaken by Anderson and Betsill (2010) indicates that some researchers view policy engagement as an appropriate role for researchers. When researchers engage with the policy process, they influence the use of scientific knowledge within policy-making (Pielke, 2007).

Beyond informing policy, there are perspectives that advocacy is a vehicle for public discourse. Besley and Nisbet (2013) found that researchers consider it part of their role to engage in public debates and view policymakers as the most important group to engage. Furthermore, some researchers feel they have a basic responsibility to interact with the public (Weigold, 2001), an obligation to serve society (Nelson & Vucetich, 2009) and a sense of responsibility to contribute to the broader society discourse (Carney, 2014; Gascoigne & Metcalfe, 1997). In fact, some believe a failure to engage in advocacy could harm society

(Nelson & Vucetich, 2009) as access to information underpins an informed democracy (Lubchenco, 2017). Although researchers are willing to communicate with the public and make a difference through engagement—whether science communication or advocacy (Besley et al., 2018)—this desire is not held by all researchers.

One of the most common concerns researchers express in relation to advocacy is the implications an advocacy stance may have for their professional credibility and objectivity (Dudo et al., 2014). Researchers who show a lack of impartiality during communication or advocacy can create the perception of bias, which has the potential to further affect their credibility in the eyes of the public, policymakers and other researchers (De Boer et al., 2005). This is linked to concerns researchers hold over erosions of authenticity and trust in researchers by the public. Trust plays a critical role in the communication of scientific information (Brewer & Ley, 2013), with Hmielowski et al. (2014) finding that trust in researchers is crucial for people who are reporting their opinions on science topics.

Additionally, some researchers are concerned with inaccurate media depictions of their research (Besley & Nisbet, 2013; Dudo et al., 2014), fear of public backlash or unintentional political consequences (Cockrell et al., 2018), negative feedback from colleagues (Besley & Nisbet, 2013; Dudo et al., 2014) and their scientific reputation suffering as a result of advocacy (Mackey, 1999). Some researchers hold in disdain those who publicly engage as they believe researchers should remain humble and dedicated to their work, letting the research speak for itself (Shortland & Gregory, 1991). Lastly, time conflicts, for example, creating multiple different styles of communication outputs in addition to their other requirements, such as teaching, are suggested by some researchers as being a factor in their unwillingness to engage in advocacy (Dudo et al., 2014).

1.2.3 Models of Science Communication and Advocacy

There are strong arguments both for and against researchers acting in an advocacy capacity. However, considering researchers are under continued pressure to be outward-looking and engaged with public communication, it seems that some forms of advocacy may be unavoidable (Schmidt, 2015); it may, in fact, be necessary for effective science communication. There are two ways of viewing this interaction between the roles of researcher and advocate. The first, suggested by Pielke (2007), proposes that there are four distinct categories (Table 1.1) that individuals can be classified into when engaging in science communication (pure scientist, science arbiter, issue advocate and honest broker of policy alternatives). Researchers engage in a process of self-reflection and select a position dependent on who they are communicating with and the intended purpose of their communication.

Table 1.1

Pielke Categorical Model

Pure Scientist	**Issue Advocate**
A pure scientist has no interest in the decision-making process and simply wants to share fundamental information with the decision-maker. The pure scientist focuses on research with absolutely no consideration for its use or utility and thus in its purest form has no direct connection with decision-makers.	An issue advocate focuses on the implications of research for a particular political agenda. Unlike the pure scientist, the issue advocate aligns themselves with a group seeking to advance its interest through policy and politics.
Science Arbiter	**Honest Broker of Policy Alternatives**
A science arbiter serves as a resource for the decision-maker, standing ready to answer factual questions that the decision-maker thinks are relevant. The Science Arbiter does not tell the decision-maker what they ought to prefer.	An honest broker of policy alternatives engages in decision-making by clarifying and, at times, seeking to expand the scope of choice available to decision-makers.

A second interpretation of the interaction between science communication and advocacy was put forth by Donner (2014). This model proposes that science and advocacy should be viewed at opposite ends of a continuum, with many possible positions an individual may occupy along the continuum (Figure 1.1). Within this perspective Donner (2014) attempted to provide a solution to what he deemed to be a dilemma that researchers often face: how to choose between what is perceived as science, being honest and what is perceived as advocacy, being effective. This continuum model suggests that researchers can be ‘scientific’ about their public engagement and choose a suitable place for themselves along the science–advocacy continuum. This model also suggests that the chosen position

along the continuum is not concrete and can be re-evaluated each time science communication is engaged. However, Donner (2014) cautions about the implications of labelling advocacy-type positions in certain circumstances, suggesting that being labelled an advocate could follow a researcher long after the initial communication.

Figure 1.1

Adaptation of Donner Science–Advocacy Continuum



While both models offer conceptually sound theoretical strategies for researchers engaging in science communication, it is not necessarily clear how practically relevant each model is. For instance, it may not be practical for researchers to constantly engage in self-evaluation and scrutinising processes to determine the best perspective when choosing to engage in science communication. These models also do not address whether researchers actually have the skills or knowledge to engage in these processes—to determine the purpose, intended audience and most appropriate outcome from their science communication. These models seem to suggest that researchers must constantly and consistently evaluate their engagement with science communication and what specific stance they may want to take. This, however, does not consider the demands on the researcher's time as a consequence of this extensive process of self-scrutinisation and evaluation. Furthermore, there is no consideration for when researchers are potentially ambushed with unexpected questions by the media when engaging in communication nor consideration of organic science communication that happens without specific, premeditated intentions.

1.3 Conceptualising the Communication of Science in Australia

Science communication bridges the scientific community and the broader public, facilitating the exchange of knowledge, fostering understanding, and empowering individuals to make informed decisions (Burns et al., 2003). The science communication landscape in Australia is characterised by a rich tapestry of initiatives, spanning traditional media outlets, digital platforms, citizen science projects and educational programs (Gascoigne & Metcalfe, 2017). Traditional media and broadcasting within Australia can be considered partisan, falling broadly along the left-right political divide (Gans & Leigh, 2012; Gascoigne & Metcalfe, 2017). In the progressive centre-left are programs such as The Australian Broadcasting Corporation, which has played a central role in science communication through its dedicated science programs, documentaries, and online platforms (Gascoigne & Metcalfe, 2017; Metcalfe & Gascoigne, 1995).

However, on the other side is media outlets, primarily Murdoch Press, which tailor news and media predicated on alternative viewpoints that tend to focus on a right-wing political agenda (Gascoigne & Metcalfe, 2017; Sinclair, 2016). With respect to print and online publications, similar partisan reporting patterns are seen across the Newscorp newspapers and Fairfax media outlets (Gallagher, 2019). However, online publications within this media landscape contribute to Australia's vibrant science communication ecosystem. Online platforms such as The Conversation and the Australian Science Media Centre (AusSMC) provide spaces for researchers to engage directly with journalists and the public, offering expert commentary and analysis on current scientific issues (Riedlinger et al., 2021).

There has been an increase in modern science outreach initiatives, which have gained traction in Australia and include things such as citizen science, science festivals and public events (Bonney et al., 2014; Roger et al., 2019). Citizen science initiatives empower citizens to actively contribute to scientific research and monitoring efforts (Roger & Motion, 2022).

Projects like ‘Birds in Backyards,’ ‘FrogID’ and ‘Redmap’ invite individuals to observe, record and report data on wildlife sightings, biodiversity and environmental changes (Pecl et al., 2019). These initiatives generate valuable scientific data, foster a sense of environmental stewardship and community engagement, and strengthen scientific knowledge (Roger & Motion, 2022). Science festivals and public events offer immersive experiences that bring science to life for people of all ages. Events such as the Sydney Science Festival, National Science Week and the World Science Festival Brisbane feature interactive exhibits, workshops, talks and performances, showcasing the diversity and excitement of scientific exploration. These festivals serve as platforms for researchers, educators and science communicators to engage directly with the public and ignite curiosity about the natural world.

1.3.1 Political and Economic Considerations for Science Communication

When considering the science communication landscape in Australia, there are political factors such as governmental priorities and funding, the politicisation of science and the spread of misinformation and disinformation to serve political agendas that influence science communication. For instance, Australia has a four-year political cycle, meaning that shifts in political leadership and policies (e.g. support for climate change research or renewable energy) affect the communication of certain scientific fields and whether some areas receive more visibility based on government endorsement (Australian Academy of Science, n.d.). Furthermore, the Australian government’s funding priorities shape the types of scientific research that are communicated to the public. Specifically, the Australian government’s investment in research and development (R&D) is critical in driving innovation, fostering economic growth, and addressing societal challenges (Australian Academy of Science, n.d.). The Australian government allocates funding for R&D through various channels, including federal budgets, research grants, tax incentives, and collaborative partnerships with industry and academia (Australian Academy of Science, n.d.). Government

spending on R&D in Australia is distributed across multiple sectors, reflecting diverse priorities and objectives. Key investment areas include health and medical research, environmental sustainability, advanced manufacturing, digital technologies and defence innovation (Australian Academy of Science, n.d.). Government funding for R&D has yielded tangible outcomes and societal benefits, ranging from breakthrough scientific discoveries to technological innovations and improved public services (Harman, 2010). Investments in medical research have led to advances in treatments, diagnostics and preventive strategies for diseases such as cancer, diabetes and infectious diseases (Zurynski et al., 2021). Similarly, investments in renewable energy, climate science and environmental conservation have contributed to Australia's transition towards a more sustainable and resilient future (Bourke & Butler, 1999; Howell & Rodger, 2018).

Despite the importance of R&D investment, Australia faces challenges in maintaining and increasing funding levels, particularly in the face of competing budgetary priorities and economic constraints (Australian Academy of Science, n.d.). The decline in public R&D expenditure as a percentage of GDP in recent years has raised concerns about Australia's global competitiveness and capacity for innovation (Climie et al., 2020). Addressing these challenges requires sustained political will, strategic planning and collaboration between government, industry and the research community. Moreover, there are opportunities to enhance the effectiveness and impact of R&D investment through strategic allocation, prioritisation of emerging technologies and industries, and fostering greater collaboration between research institutions, businesses and government agencies (Arora et al., 2018). Consequently, the budget allocations for scientific agencies, universities and research centres have the potential to affect science communication efforts.

Interestingly, while government priorities and funding influence science within Australia, at the science-policy interface, public policies are influenced by scientific

communication and vice versa (Pielke, 2007). For instance, the communication of evidence-based policy in areas such as health care, climate change, energy and innovation can shape public and political discourse. This can be further exacerbated by scientific issues (e.g. environmental policies, pandemic response, or education reforms) becoming part of political rhetoric (Staerklé et al., 2022). This includes both the communication of scientific evidence and how it is framed or misrepresented in political debates (Dempster et al., 2022; Webb et al., 2020). This political polarisation of science can influence the public's perception of science, such that political ideologies influence public trust in science, particularly in polarising areas such as climate change, vaccination, and genetic engineering (Dempster et al., 2022; Motta & Stecula, 2021). This can lead to the spread of misinformation and disinformation, with political actors at times contributing to the spread of misinformation or disinformation about scientific topics to support their own political agendas (Ricard & Medeiros, 2020).

Additionally, the media in Australia plays a role in shaping the political narrative around science, where certain scientific findings may be downplayed, exaggerated, or misrepresented depending on political leanings (Metcalfe & Gascoigne, 1995). Consequently, researchers must navigate these divides from misinformation and disinformation campaigns when engaging in science communication. The challenge of navigating this space may be exacerbated by the type of communication researchers chose to engage in and shape both the dissemination and reception of scientific knowledge.

1.3.2 Cultural Influences on Science Communication in Australia

When examining the landscape of science communication in Australia, it is essential to consider the cultural influences shaping how science is conveyed and understood. Cultural values, identities and social norms play a critical role in shaping communication strategies, affecting public engagement and trust in science. Australia is a highly multicultural nation

and home to a diverse population comprising various ethnic, linguistic and cultural groups (Syed & Kramar, 2009). This diversity necessitates that researchers acknowledge and adapt their communication strategies accordingly, including the development of multilingual resources and culturally tailored outreach initiatives. Moreover, cultural representation within the scientific community and media is key to fostering inclusive science communication. While some progress has been made toward gender equity in media representation, there remains a broader bias toward Anglo-European perspectives, particularly in journalism. This lack of cultural diversity can contribute to structural inequities within democratic institutions, as minority perspectives and cultural knowledge are often undervalued in governmental and media organisations (Moieni, 2020). Ensuring that science communication reflects the diversity of the population is crucial, as representation can enhance public trust and engagement with science.

An emerging area of focus in Australian science communication is the recognition and integration of Indigenous knowledge systems. Increasingly, there is an acknowledgement of the value of Indigenous Australian epistemologies, particularly in disciplines such as environmental management, biodiversity conservation and astronomy (Ayre & Mackenzie, 2013; Birch, 2016; Bohensky et al., 2013; Ens et al., 2012). Given the fundamental differences between Indigenous knowledge systems and Western scientific paradigms, researchers must be mindful of how Indigenous science is communicated and respected alongside Western methodologies (Metcalfe & Gascoigne, 2020). Additionally, effective science communication in Indigenous communities requires culturally sensitive approaches that consider factors such as language, storytelling traditions and the significance of place-based knowledge (Finlay et al., 2021; Márquez & Porras, 2020; Wild et al., 2021). While not all science communication efforts may require such considerations, they remain essential in ensuring inclusivity and engagement across diverse communities.

1.3.3 Barriers to Inclusive Science Communication

Despite Australia's vibrant science communication ecosystem, significant challenges persist in reaching diverse audiences and promoting scientific literacy across the country's vast and multicultural landscape (Márquez & Porras, 2020). Barriers such as the digital divide, language diversity, and cultural sensitivity must be addressed to ensure equitable access to scientific information (Bray et al., 2012; Nisbet & Scheufele, 2009). Collaborative efforts between researchers, policymakers, educators, and Indigenous communities are essential in co-developing culturally and linguistically relevant science communication strategies (Gascoigne & Metcalfe, 2017). The increasing reliance on digital platforms for science communication presents opportunities and challenges. Social media has transformed how scientific information is disseminated and consumed; however, it also presents concerns related to algorithmic biases, the spread of misinformation and the erosion of trust in scientific expertise (Osterhage & Rogers-Carpenter, 2022; Parker et al., 2021; Reyna, 2021). Addressing these challenges requires innovative communication strategies and cross-sector collaborations that prioritise inclusivity and accessibility, particularly in response to the growing societal demand for clear, accurate and effective science communication.

1.3.4 Cultural Influences on Trust in Science

Cultural perspectives play a significant role in shaping public trust in science and, in turn, influence how researchers communicate science. Different cultural groups within Australia may hold varying attitudes toward science based on factors such as religious beliefs, traditional knowledge systems, or past experiences with scientific institutions (Örnek, 2015). These perspectives influence the reception, engagement and acceptance of scientific information. Moreover, cultural backgrounds can affect trust in scientific institutions, researchers, and the credibility of the information that researchers communicate (Jackson, 2019). One key determinant of trust in science is the perceived expertise and competence of

the communicator. Individuals are more likely to trust scientific information from authoritative sources, including reputable scientific institutions, peer-reviewed journals, and experts with relevant credentials (Wintterlin et al., 2022). This highlights the importance of fostering public trust through transparent and effective science communication. However, cultural mistrust of government or academic institutions can undermine the credibility of science communication, particularly among historically marginalised or sceptical communities.

In addition to cultural factors, ideological beliefs also influence trust in science. People are more likely to accept scientific information that aligns with their values, worldviews and ideological perspectives (Kahan, 2013; Kunda, 1990; Lewandowsky & Oberauer, 2016; Rudolph & Hetherington, 2021). This dynamic can contribute to polarisation and scepticism, particularly regarding politically contentious scientific issues (Rutjens et al., 2018). Furthermore, public trust in science is shaped by perceptions of scientific consensus. Research suggests that when a strong majority of scientists agree on a particular issue—such as climate change or vaccine efficacy—public confidence in the validity of the evidence may increase (Chinn et al., 2018). However, effectively communicating scientific consensus requires careful attention to framing, messaging, handling uncertainties and acknowledging and addressing dissenting views within the scientific community. Given these complexities, it is essential that science communication adopts a culturally inclusive approach that recognises and respects diverse perspectives. Strategies such as public forums, community engagement initiatives, and citizen science programs can effectively foster trust and participation in scientific discourse across different cultural and ideological contexts.

1.4 Conclusion

In conclusion, researchers are increasingly called upon to act as arbiters of truth and justify policy decisions, particularly in the face of the growing threat of misinformation and

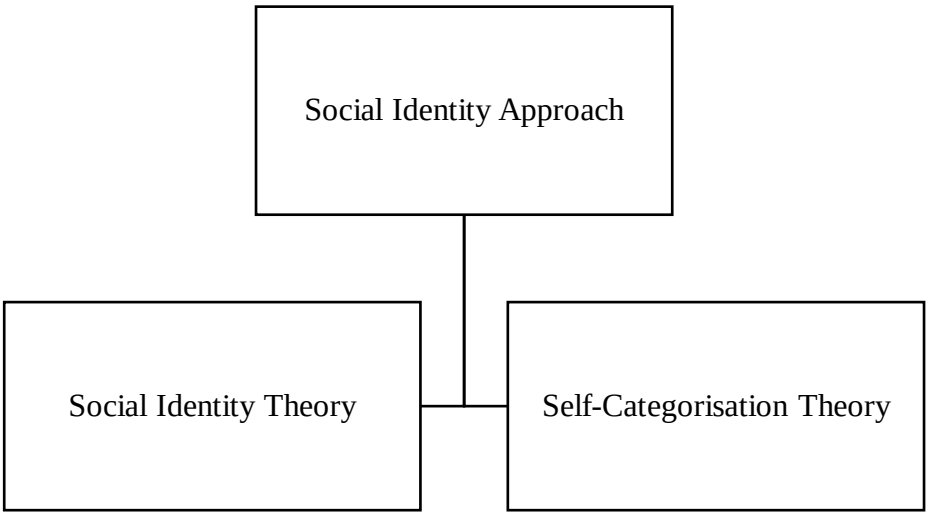
disinformation. However, the field of science communication itself is marked by uncertainty and disagreement. Researchers, policymakers and communicators face ongoing debates about the various forms science communication can take, the role of advocacy and the consequences of different engagement strategies, especially regarding public trust in science and its role in decision-making. This chapter has explored these challenges by providing an overview of the current political, economic and cultural landscape in which science communication occurs. Significant attention has been given to the methods of communication (Burns et al., 2003; De Boer et al., 2005; Gregory & Lock, 2008; Weigold, 2001; Yeo et al., 2018), but much less focus has been placed on the psychological underpinnings of the researchers themselves—the individuals responsible for communicating scientific knowledge. The following chapter delves into the theoretical foundations of the SIA, offering a framework for understanding the experiences and motivations of these communicators.

Chapter 2: Social Identity Approach

The SIA has two main focuses (Figure 2.1), which are conceptually aligned and which encompass SIT (Tajfel & Turner, 1979) and SCT (Turner et al., 1987). SIA offers a robust framework for examining the dynamic relationship between personal identity and group membership. These theories provide insight into how individuals define themselves within group contexts, how group affiliations shape behaviours and attitudes, and how intergroup dynamics influence personal and collective identities (Abrams, 1990; Abrams & Hogg, 1990; Hogg, 2016).

Figure 2.1

Visual Conceptualisation of the Main Focuses of Social Identity



At the core of SIT is the assertion that individuals derive part of their self-concept from their membership in social groups (Tajfel & Turner, 1979). These social identities contribute to self-esteem and shape perceptions of in-groups (groups to which one belongs) and out-groups (those to which one does not). Turner (1982) and Tajfel (1982) argued that social categorisation is a cognitive mechanism that helps individuals simplify and make sense of the social world. This categorisation often results in positive bias toward in-group members and, at times, negative attitudes or discrimination against out-groups, reinforcing

group boundaries and promoting group cohesion (Hogg & Turner, 1987; Tajfel, 1982; Tajfel & Turner, 1979). Such processes are critical in understanding how social identity drives behaviours aimed at enhancing the status of one's own group relative to others (Brown & Pehrson, 2019). In essence, SIT focuses on the analysis of intergroup relations and social change as a result of the pursuit of positive distinctiveness.

SCT, developed by Turner et al. (1987), expands upon SIT by focusing on the processes through which individuals classify themselves and others into various social categories. SCT (or SIT of the group) focuses on the role played between cognitive process and representations associated with social categorisation that underpin and generate group and intergroup processes and phenomena. Self-categorisation is context-dependent and flexible, shifting based on situational and social factors (Turner et al., 1987). SCT explains that individuals can define themselves at multiple levels of abstraction, ranging from personal identity (as unique individuals) to social identity (as members of a collective). The theory highlights that group norms and prototypical behaviours are critical in shaping both individual and collective behaviours, and social comparison plays a significant role in defining group identity and intergroup behaviour (Hogg & Terry, 2000).

Both SIT and SCT provide important frameworks for understanding the interplay between individual and group-level processes, particularly in contexts where identity is salient and social comparisons are prominent (Hornsey, 2008). These theories have been widely applied to diverse areas of social psychology, including intergroup relations, prejudice, leadership, and communication (Abrams & Hogg, 2004; Hogg, 2016). The application of the SIA is particularly relevant to this thesis, as it offers a valuable framework for exploring the professional identities of researchers and the behaviours they engage in when enacting these identities, such as science communication or advocacy. Moreover, as researchers increasingly navigate the dual roles of academic and public communicator, SIT

and SCT provide critical insights into how researchers manage the tensions and conflicts arising from multiple, sometimes competing, identity demands (Ashforth, 2000; Ellemers & Haslam, 2012). This thesis explores intergroup relations and the individual self in relation to the group, taking a more holistic SIA rather than focusing on one of the sub-theories. Consequently, this chapter provides a general overview of the development of SIT and SCT, followed by an outline of the key principles of each theory and, finally, a discussion of the limitations of the SIA.

2.1 Social Identity Theory

SIT suggests that people have a personal and social identity (Abrams & Hogg, 1990). The theory focuses on social rather than personal identities and indicates that we all have social identities (often more than one). According to the theory, these social identities occur because, in social situations, people think of themselves and others as group members rather than as unique individuals. This social identity allows people to describe and evaluate who they are within social contexts and explains how we come to view the world in terms of ‘us’ and ‘them’. It argues that this occurs because ‘we’ as humans have an innate desire to create meaning and order and understand the social world around us. This position suggests that humans develop social identities to make sense of the world around them and inform how they behave in social situations. Consequently, SIT proposes that individuals derive value from this group membership and tend to categorise themselves into groups to gain a greater sense of who they are (Spears, 2011). Therefore, the main aim of SIT is to understand and explain how people can come to adopt a social identity (group identity) and how they behave in terms of their social identity rather than their personal identities (Tajfel, 1974).

SIT analyses the interplay between self-concept—or how we view ourselves—and group membership, group processes and intergroup relations (Hogg, 2018). The main premise of SIT contends that group phenomena cannot be adequately explained by specific individual

processes or interpersonal interactions alone. Instead, to explain group phenomena, a greater focus should be placed on the social environment in which this behaviour occurs. Therefore, SIT defines social identity as the part of an individual's self-concept that is developed from the internal knowledge of their membership of a social group, together with the value and emotional significance attached to that membership (Tajfel, 1972, 1974, 1978). SIT argues that the relevance and strength of someone's social identity affect their behaviours and attitudes towards individuals from different groups (Haslam et al., 2000). Therefore, SIT attempts to explain the implications of social identity on the perceptions and behaviours of individuals and how these affect social relations between individuals and groups.

2.1.1 Fundamentals of the Social Identity Theory

SIT distinguishes between social identities and personal identities, with people having as many social and personal identities as groups and personal relationships with which they are associated. For clarity, personal identity is understood as self-construal (how a person defines themselves) in terms of personal attributes not shared with others ('I') or personal dyadic relationships ('me' and 'you'). In contrast, social identity (or group identity) is a collective self-construal or how a person defines themselves with a focus on group membership ('we' and 'us' versus 'them'; Hogg, 2018). Importantly, people who have lots of diverse social identities are viewed as having a complex social identity and are considered more resilient than those with fewer and strongly overlapping social identities (Grant & Hogg, 2012; Roccas & Brewer, 2002)

According to SIT, a group is considered a group if three or more people view themselves as group members by identifying shared attributes that distinguish themselves collectively from others (Hogg, 2018). From an SIT perspective, the crucial point here is that groups are defined cognitively, meaning that it is a person's identification as a group member that makes a group, a group. According to Tajfel (1975), groups are not only external features

of the world but are also internalised and contribute to a person's sense of self. However, because individuals may belong to more than one group, their social identities may be similarly divided. It is suggested that only one identity is psychologically salient to govern self-construct, social perception and social conduct, indicating that certain identities are 'activated' or expressed in some situations and not others (Hogg, 2018). This is because different situations may call for different expectations and behaviours, implying that as contexts and situations change, so does the salience of identity. Consequently, one may come to the front over another. Therefore, which social identity is activated depends on the context, with certain situations making one social identity more salient or relevant than another (Turner et al., 1987). From this perspective, an individual's social identity is important because it becomes the primary determinant of their social behaviour and perceptions in different settings (Ellemers & Haslam, 2012).

2.1.2 Social Identity Theory Conceptual Structure

According to SIT, three mechanisms are fundamental in an individual developing a social identity and are the foundation upon which SIT rests. SIT hypothesises that there is a psychological process which is the mechanism that supports the tenets of the theory. This psychological process involves social/self-categorisation, social identification and social comparison (Table 2.1). In this process:

1. People may define themselves and others as members of social groups (*social categorisation)*
2. On the basis of this classification certain group characteristics are ascribed to individual group members (*social identification)*
3. And these characteristics may compare positively or negatively to the characteristics of other groups (*social comparison)*.

Table 2.1

Psychological Mechanisms of Social Identification Theory

	Psychological Mechanisms
Social/self-categorisation	The tendency for people to categorise themselves and others into social categories instead of as separate individuals.
Social identification	Social identification is when an individual adopts the identity of the group they have categorised themselves as belonging to.
Social comparison	The process in which people unconsciously categorise individuals who are similar to themselves as members of an 'in-group' while those who differ from the individual as part of the 'out-group'.

SIT was further extended in an attempt to explain different strategies that people can employ to cope with a devalued social identity and the characteristics of the social structure that determine which of these strategies is most likely to be used in any given situation (Tajfel & Turner, 1979). Identity management strategies suggest various tactics that members of low-status social groups can adopt to address their situation and improve the value of their social identity (Caddick, 1982). In contrast, socio-structural characteristics describe conditions under which people are predicted to pursue these different strategies for social identity maintenance or improvement (Ellemers, 1993). These different strategies and conditions have been defined below (Table 2.2), and the operationalisation of these mechanisms within the empirical literature will be investigated in the following sections.

Table 2.2

Identity Management Strategies and Socio-Structural Characteristics of Social Identity Theory

Identity Management Strategies	
Individual mobility	Individual mobility is an individual-level strategy that people can employ to avoid, escape, or deny belonging to a devalued group and attempt to be included in a group of higher social standing.
Social creativity	Social creativity is a process where group members seek to redefine intergroup comparison by representing the in-group in terms of positive rather than negative characteristics.
Social competition	Social competition is a strategy whereby group members engage in forms of conflict designed to change the status quo.
Socio-Structural Characteristics	
Permeability	Permeability is an individual's perception of the permeability of their group boundaries. If boundaries are seen as permeable, individuals will be more inclined to pursue things like individual mobility as an attractive and viable strategy. If boundaries are perceived to be impermeable, then individuals are likely to feel more bound to their group.
Stability	Stability of group status refers to the idea that some differences between groups are fluid and subject to change, while other differences are more enduring and stable over time.
Legitimacy	Legitimacy refers to different aspects of a social situation (such as the status quo) that may motivate an individual to want to change their perceived status.

2.1.2.1 Psychological Processes.

2.1.2.1.1 Social/Self-Categorisation. According to SIT, social categorisation is a common psychological process that provides a way of responding to complex social

situations. The mere act of categorising someone as a group member changes how you view them (Turner et al., 1987). Instead of seeing someone as a unique individual, the person is viewed through the lens of the group, assessing them against what is expected of a member of that group and assigning specific group attributes to them. The process of social or self-categorisation leads to depersonalisation of yourself or the person you are categorising, which in turn leads to a depersonalisation of both those in the in-groups and those in the out-groups (Hogg, 2018). The process of depersonalisation of those in the out-group leads to stereotyping as it primes 'them' to be viewed as being similar to one another and all having out-group attributes. When an individual categorises themselves the same depersonalisation process occurs. However, individuals instead view themselves in terms of the attributes of the in-group. Because group attributes describe and proscribe group-appropriate ways to feel and behave (group norms), individuals begin to act and feel in group-normative ways.

The notion of social categorisation developed from Tajfel et al.'s (1971) minimal group study. This study assessed the effects of social categorisation on intergroup behaviour; finding that the mere act of categorising individuals into groups made these individuals think of themselves and others in terms of 'us' and 'them'. This study does, on the surface, support the tenets of social categorisation, given that the study demonstrated how individuals can change how they treat others based purely on viewing an anonymous person as belonging to a different group. However, there are several issues with the validity of the findings from this study. The original (Tajfel, 1974) study implemented a simple social situation of us vs them, so its relevance to complex situations is unclear. It also used groups that are not naturally occurring and, as a result, may not support social categorisation in a real-world setting. Furthermore, Tajfel examined social categorisation from a positive perspective (by requiring participants to allocate more points to one group than another). However, this in-group and

out-group favouritism suggested by social categorisation should also apply in the negative (allocating more negative outcomes to the out-group than your own in-group).

Testing this concept of negative group bias, Mummendey et al. (1992) conducted a series of experiments that indicated that when the rewards typically distributed in the minimal paradigm were replaced with negative outcomes (exposure to an aversive noise), discrimination virtually disappeared. This study followed the same design as the minimal group studies in that participants were allocated to groups on an arbitrary basis, but rather than distributing points between groups, the participants were tasked with distributing the exposure to a loud noise between groups (both members of their in-group and out-group). The results indicated that the subjects did not favour the in-group over the out-group but instead used fairness as the distribution strategy.

However, in a follow-up study, in-group favouritism was again demonstrated when further attributes were given to the groups, such as relative group size and relative group status (Mummendey et al., 1992). A minority group perception was manipulated by telling participants that 80% of the population belonged to the in-group and 20% to the out-group and vice versa (majority v minority conditions). The status of groups was manipulated by telling participants that their own group (in-group) or the other group (out-group) were better at a perception task (a task participants completed before group allocation) or vice versa (high v low-status conditions). When these additional factors were added (altering the status and size of the in-group), mixed results were found. That is, those in the low-status minority groups showed a pattern of in-group favouritism of distributing more of the aversive stimuli to the out-group. However, in-group favouritism was not found in high-status majority groups, low-status majority groups or high-status minority groups. The authors suggested that being allocated to a minority and a low-status group motivated participants to achieve a positive social identity (Mummendey et al., 1992).

These results indicate that the psychological processes of social categorisation seemed to only strongly apply to discrimination and favouritism as mechanisms to elevate group status and qualities. However, again this research was only conducted using non-naturally occurring groups, which is useful to isolate potential mechanisms for intergroup relations but does not capture the full complexity of real-world group relations. For instance, it could be argued that group membership was simply irrelevant to the subjects in such a clinical experiment owing to the arbitrary allocation to a group. Therefore, individuals did not behave with group characteristics and outcomes in mind. Therefore, additional evidence would need to be gathered for conclusions to be drawn regarding discrimination and favouritism.

Abbink and Harris (2019) studied in-group favouritism and out-group discrimination, specifically using naturally occurring and politically conflicting groups to tease apart this gap in relation to real-world or naturally occurring groups versus lab-based groups. These naturally occurring groups were identified three months prior to the commencement of the experiment by surveying university students to identify supporters of Yellow Shirts (also known as the People's Alliance for Democracy) and Red Shirts (also known as the United Front of Democracy Against Dictatorship) and those who identified with neither group (viewed within the study as a non-rival out-group). The researchers aimed to clarify in-group favouritism and out-group discrimination by introducing a non-rival out-group as a reference point against which in-group favouritism and out-group discrimination could be measured. The groups were tasked with allocating sums of money amongst the three groups of players (yellow shirts, red shirts and those who supported neither). The results showed both in-group favouritism and out-group discrimination among the naturally occurring groups. However, only favouritism and no discrimination were observed in the artificial groups. These results suggest that favouritism and discrimination are not driven by the same motivation and that only when groups are in conflict is it likely that out-group discrimination is likely to occur.

Although there is conflicting evidence discussing the discrimination seen between in-group and out-groups, there is support for the notion that individuals engage in a process of social categorisation (Abbink & Harris, 2019; Inguglia & Musso, 2013; Nam & Chen, 2021; Reichl, 1997; Voci, 2006).

Proponents of SIT contend that social categorisation is important because thinking of individuals in terms of a limited number of social categories provides a basis for organising socially relevant information and helps in the process of understanding and predicting behaviour (Ellemers & Haslam, 2012). This classification of individuals into different groups is based on perceived similarities between individuals such that when individuals are categorised into the same group, they are thought to share some central group-defining features that distinguish them from others who do not possess these features (Tajfel, 1978). Those in the same category have a shared representation of common characteristics. This is supported by research conducted by Park et al. (2021), who examined the role of social norms in the context of entertainment media selection based on SIT. Participants who self-identified as White American, Asian/Asian American or Black/African American completed an online survey where they were presented with a random array of six films from which they could select one film they would like to have a sequel. Descriptive and injunctive norms were reportedly measured using a scale adapted from Park and Smith (2007). In-group preferences and identity were measured using the Rimal and Real (2005) scale for group identity. Results indicated that social identity, norms and in-group preferences affected movie selection differently. Participants tended to select movies featuring their own groups (ethnic groups) when they had stronger preferences for their own groups and perceived stronger norms from their group. These results indicated that people selected films featuring individuals who had perceived similarities to themselves. Taken together these results suggest that the idea of social or self-categorisation is clearly a phenomenon present within society. However the

measurement of this construct and the settings within which it occurs (during discrimination and favouritism) is difficult to measure, especially in naturalistic as opposed to lab-based settings.

2.1.2.1.2 Social Identification. SIT stipulates that social identification occurs when an individual adopts the identity of the group they have categorised themselves as belonging to. This not only refers to the awareness that one can be included in a particular group but also speaks to the emotional significance that group membership has over the individual (Tajfel, 1974). Proponents of SIT argue that to the extent that people care about the groups they belong to (in-groups), they will be motivated to emphasise the distinct identity of this group and to uphold, protect or enhance the value afforded to those groups and their members. Occasionally, this may occur at the expense of other groups and their members (out-groups). It is further suggested that the social identification of oneself as belonging to the 'in-group' or 'out-group' also has implications for one's perception of and response to social situations (Diehl, 1990). For example, if we were to categorise ourselves as managers then we are more likely to adopt the identity of a manager and start acting and behaving like a manager. According to SIT, this behaviour will start to feel normal, and individuals will start conforming to the norms and standards of the group to which they identify as belonging.

Importantly, according to Tajfel (1982), three mechanisms are necessary for identification to take place: specifically, a cognitive component, which refers to the awareness of one's membership in a group; an evaluative component, wherein this awareness is assigned a value judgement; and an emotional component, involving an emotional investment in both the awareness of membership and its evaluation. There is support for social identification within the literature (Cárdenas et al., 2021; Greenaway et al., 2015; Heath et al., 2023; Steffens et al., 2017). For example, Bliuc et al. (2011) examined the role of social identification in the learning of university students and found that social

identification was successful in predicting the academic achievement of university students. Specifically, students' social identification as a university student positively predicted their academic achievement. This highlights the importance of internalising individuals' group membership into aspects of their self-concept and the positive (or negative) implications this internalisation can have.

Social identification is further supported by research conducted in the Netherlands by Verkuyten and Martinovic (2012). Using three studies, the authors researched those who identified as Muslim immigrants (minority) and examined the complexity of the individual's social identity and their attitudes towards those from the host majority (Dutch). Social identity complexity refers to the variation in how individuals perceive and manage the relationships among their multiple in-group identities. It is important in the context of professional identities because it helps explain how individuals navigate the often overlapping and sometimes conflicting identities and roles within the professional context. Study 1 indicated that lower social identity complexity was associated with lower national identification. Studies 2 and 3 explored the interaction between ethnic and religious group identification. Among Muslim identifiers, stronger ethnic identification was associated with reduced national identification, increased in-group bias (Study 2) and lower endorsement of national liberal practices (Study 3). In contrast, for those with weaker Muslim identification, higher ethnic identification corresponded with greater national identification, stronger support for Dutch liberal practices and more positive stereotypes toward the Dutch out-group (Study 3—where the interaction between ethnic and religious group identification was explored). The implication of this in a professional identity context allows for an enhanced understanding of how people can say they are both 'A' and 'B' or hold overlapping or conflicting identities within the professional sphere, thereby underscoring the necessity for

integrative frameworks that accommodate the complexities of multiple in-group affiliations within professional and organisational contexts.

2.1.2.1.3 Social Comparison. While social categorisation refers to the process of classifying oneself and others into social groups (or categories) based on shared characteristics, social comparison occurs after social categorisation and involves comparing one's in-group to relevant out-groups to evaluate the relative status, value or prestige of one's group. Social comparison allows individuals to assess the superiority or inferiority of their group in relation to others and reinforces group identity by emphasising group distinctiveness (Stets & Burke, 2000). This distinction of creating in-groups and out-groups can be seen within the literature. For example, Voci (2006) examined the link between identification and in-group favouritism, demonstrating that the relation between identification and in-group favouritism is reliable in the intergroup context. Tajfel (1978) argues that the characteristics of groups, such as their attitudes, traits and behaviours, are used to determine whether that group is 'good' or 'bad' based on comparing these characteristics to the other groups. Although in-group and out-group distinctions can be seen within the literature, Tajfel's assertion of 'good' or 'bad' is much less clear. For example, Inguglia and Musso (2013) researched in-group favouritism and out-group denigration towards national groups among Italian children aged 6–12. They found that children usually exhibit in-group favouritism. However, out-group discrimination was less common because many out-groups were viewed positively to a lesser degree than the in-group. These findings suggest that social comparison is less about a good versus bad dichotomy than a 'more good' or 'more bad' continuum.

SIT further suggests that individuals make comparisons between groups because of a desire to maintain strong self-esteem. According to Tajfel and Turner (1979), this is because humans have an innate desire to increase self-esteem. This suggests that social comparison allows for an increase in an individual's self-esteem by evaluating the in-group and the out-

group on dimensions leading to the in-group being judged positively while the out-group is judged less positively (Stets & Burke, 2000). Individuals generally view their own groups as superior and others as inferior to boost self-esteem. There is support for the role that self-esteem plays in social comparison in studies such as the ‘Basking in Reflected Glory’ study conducted by Cialdini et al. (1976). This study gathered data on college campuses to examine the tendency to bask in reflected glory by announcing one’s associations with someone or something else that is successful. Cialdini et al. (1976) gave students a general knowledge test and rigged the results so that half the students would succeed and half of them would fail. The students were then asked to describe the outcome of a recent university football game in their own words. When describing these football games, those students who thought they had just failed a test were more likely than those who thought they had succeeded to share in their team’s victory by stating that ‘we won’ and to distance themselves from the team’s defeat by stating how ‘they lost’. The study also showed that students used the pronoun ‘we’ more when describing a victory than a nonvictory of their school’s football team. These effects occurred even though the person was not involved in the success. This study demonstrates the link between social comparison and self-esteem in that individuals identify with successful in-groups to boost self-esteem. This represents an attempt to enhance one’s public image or self-esteem by associating with a successful group. Further studies show that when sports teams win, the fans use the pronoun ‘we’ (we did well), but when their team loses, the pronoun changes to ‘they’ (they lost), indicating that they are distancing themselves from the losing team (Hirt et al., 1992; Weisel & Böhm, 2015).

Other studies have supported social comparison in real-world settings. For instance, Latif et al. (2021) conducted a study exploring how social comparisons on platforms such as Facebook lead to benign or malicious envy and how these types of envy influence users’ behaviours. The research, conducted with a sample of 469 Facebook users in Pakistan, used

structural equation modelling (SEM) to analyse the data. Students participated in a survey with data collected at two time points one month apart, with responses including an identification number to match individual participant responses at each time point. In the first time point, students completed questions assessing the degree of social comparison they engaged in on social networking sites, online social identity and control variables (such as gender, age, education and daily hours spent on Facebook). At the second time point, students rated their feelings of benign envy, malicious envy, self-improvement intention and negative gossiping behaviour. This study consisted of six constructs (social comparison, malicious envy, benign envy, negative gossiping, self-improvement intentions and online social identity), all measured on Likert-type scales. The study found that social comparison triggers two types of envy: benign and malicious. Benign envy was shown to encourage self-improvement behaviours, while malicious envy led to negative gossiping. Furthermore, the user's online social identity played a moderating role in this process. When a strong online social identity was present, the effect of social comparison on benign envy was stronger, while its effect on malicious envy was weaker. This research indicates that social comparison on social media can have both positive and negative outcomes, depending on the type of envy it provokes.

2.1.2.2 Altruism and Advocacy as Identity-Driven Behaviour

An important example of the mechanisms of SIT at play in relation to this thesis is in terms of altruism and how this relates to advocacy, in the context of the communication of science. Traditional conceptualisations of altruism often frame it as a prosocial behaviour motivated by empathy, moral obligation, or a selfless concern for others. However, within the framework of SIT, altruism can be reconceptualised as a behaviour grounded in group processes and identity salience. When individuals define themselves in terms of a social identity (i.e., when the collective "we" becomes more psychologically salient than the

individual "I"), group-based norms, goals, and values become internalised, and behaviours consistent with these norms are enacted (Turner et al., 1987; Tajfel & Turner, 1979). As such, altruistic behaviour can emerge not as a departure from self-interest, but as a manifestation of the collective self.

This perspective offers a compelling lens through which to understand advocacy. Advocacy often involves acting on behalf of others—sometimes at personal cost—to promote shared goals or address injustice. While this may appear altruistic in individualistic terms, SIT suggests that such behaviour may be more accurately understood as norm-congruent action within a salient group identity. That is, individuals who identify strongly with a social group may advocate for others because doing so aligns with the values and expectations of the group and affirms their own identity as a member of that group (Ellemers et al., 2002; Thomas, McGarty, & Mavor, 2009).

Research has demonstrated that when group membership is meaningful and identity is salient, individuals are more likely to engage in prosocial behaviour toward ingroup members (Levine et al., 2005), and, in some cases, on behalf of outgroups or superordinate causes (Reicher, Haslam, & Rath, 2008). This is especially true when group norms explicitly support prosociality, justice, or collective responsibility. In such contexts, altruism and advocacy become mechanisms through which individuals enact their group identity and contribute to its maintenance or advancement. Self-categorisation further clarifies the cognitive mechanisms underpinning such behaviours. When individuals self-categorise at the group level, depersonalisation occurs—not in the sense of losing individuality, but in adopting the shared norms, goals, and values of the group as one’s own (Turner et al., 1987). Consequently, actions that benefit the group or support its aims (such as advocacy or other forms of altruistic behaviour) are not only perceived as appropriate but may also become psychologically rewarding and identity-affirming (Haslam et al., 1999). In this way, altruism

and advocacy are situated within the broader framework of identity-based motivation. Rather than viewing such behaviours solely through the lens of individual morality or personal disposition, the social identity approach emphasises the role of shared identity, group norms, and social context in shaping how and why individuals act on behalf of others. This perspective is particularly relevant to understanding collective action and group-based advocacy, where prosocial behaviour reflects and reinforces the values and boundaries of the social group.

2.1.3 Identity Management Strategies and Socio-Structural Characteristics

SIT posits that members of low-status social groups can adopt various strategies to address their social position and enhance the value of their social identity (Caddick, 1982). SIT also identifies specific conditions under which individuals are likely to pursue these strategies for maintaining or improving their social identity (Ellemers, 1993). Considering these two aspects of SIT together is essential, as they are interconnected and are often examined concurrently in research. A key challenge for identity management strategies and socio-structural characteristics lies in the notion that they are both inherently complex to operationalise and distinguish from one another.

Mummendey et al. (1999) set out to examine both identity management strategies and the socio-structural characteristics of a threatened identity. They conducted a field study in East Germany looking at intergroup relations and identity management strategies when comparing East Germans to West Germans. Participants were given a questionnaire on the perceived intergroup structure between East and West Germans (stability and legitimacy of status relations and permeability of group boundaries), in-group identification and possible reactions towards a threatened social identity (e.g. social competition, individual mobility). In general, participants from East Germany were expected to consider their status position as inferior compared with those from West Germany. Moreover, depending on whether they

regarded such a status difference as legitimate or illegitimate, as stable or unstable and whether they perceived group boundaries as permeable or impermeable, the East German participants were hypothesised to differ with respect to identity management strategies. Mummendey et al.'s results highlight both confirmations and challenges with SIT.

While SIT accurately predicted many intergroup behaviours, it needed refinement in certain areas. The results indicated a stronger influence of in-group identification than previously proposed, and socio-structural variables (e.g. legitimacy and stability of group status) predicted different identity management strategies. For example, collective action, such as social competition, is more likely when individuals perceive their group's low status as illegitimate, especially among those with strong group identification. This tendency increases when the situation is seen as stable and impermeable. In contrast, individual mobility is favoured when intergroup relations are viewed as legitimate, unstable and aligned with the dominant ideology. It is more likely when group boundaries are perceived as permeable and identification with the group is weaker. Notably, the reversal of stability predictions in assimilation contexts, where perceived stability fosters collective action and instability encourages individual strategies, suggests that SIT may need further development to account for these assimilation scenarios fully. These findings demonstrate the difficulties in effectively operationalising these mechanisms of SIT. These findings provided evidence that SIT does offer a useful framework to describe and analyse 'real' intergroup settings as they happen outside the laboratory.

These results were built on by Terry et al. (2006) who examined intergroup predictors of cultural adjustment among Asian international students in Australia by assessing status, legitimacy and permeability. The authors found that international students who perceived their cultural group as relatively low in status experienced lower levels of psychological adjustment. Furthermore, the effects of status were moderated by perceptions of both the

permeability of intergroup boundaries and the legitimacy of the status differential. Specifically, when group boundaries were perceived as permeable and legitimacy was high, international students who viewed their group as low-status experienced better psychological, sociocultural and academic adjustment. In contrast, students who perceived their group as high-status showed lower adjustment levels under these conditions. However, when legitimacy was low, perceived permeability did not influence adjustment, regardless of group status.

Verkuyten and Reijerse (2008) extended this by examining the interactive effects of perceived stability, legitimacy and group permeability on group identification, stereotypes and feelings in a real-world setting (Turkish-Dutch and ethnically Dutch participants). The findings strongly support predictions derived from SIT. For example, their findings highlight the differences in identity management strategies between Turkish-Dutch minority and ethnically Dutch majority participants, framed by perceived legitimacy, stability and permeability. For Turkish-Dutch participants, when intergroup relations were viewed as legitimate and stable, greater permeability was linked to weaker Turkish identification and stronger Dutch identification, reflecting individual mobility strategies. In contrast, Dutch participants, viewing the intergroup structure as stable and impermeable, showed increased in-group identification, lower stereotyping of Turkish out-groups, and more negative feelings towards other ethnic groups under legitimate conditions. Both of these studies support the identity management strategies and socio-structural characteristics observed in SIT.

Most of the research into identity management strategies in SIT examines these strategies in relation to protecting and enhancing self-esteem. However, the relationship between identity management strategies and personal and collective self-esteem has rarely been investigated. Alparslan and Akdoğan (2022) attempted to remedy this by examining the mediating role of identity management strategies in the relationship between perceived

discrimination and personal and collective self-esteem. The sample consisted of 138 disadvantaged Kurdish ethnic group members from Turkey. The results indicated that higher levels of collective self-esteem and competition strategies were associated with group identification but lower levels of mobility strategies and personal self-esteem. Furthermore, the tendency for increased competition strategies was related to higher collective self-esteem, whereas mobility (less opportunity to move out of the perceived lower-status identity group) was related to lower personal self-esteem.

Further support for the components of identity management strategies and individual mobility has been found in subsequent studies into disability identity, with Bosman and Thijs (2023) finding that stronger identification with the autism community along with receiving a diagnosis at a later age was associated with a greater preference for identity-first language and a reduced preference for person-first language. O'Brien et al. (2021) examined student justification for engaging in a master's degree, finding that students discursively elevated the status of the problem-based learning program they had completed, positioning it as superior to other alternatives in an effort to enhance their professional mobility.

From an organisational perspective, Hersby et al. (2009) examined the impact of socio-structural variables (permeability, stability and legitimacy of intergroup relations) on the extent to which professional women perceive a women's network as a strategy for collective status enhancement. Female employees in a global engineering company were surveyed. The results indicate that the extent to which women support and consider a network to benefit women as a collective is dependent on perceptions of whether individual mobility is possible (permeability of group boundaries) and beliefs that organisational conditions will improve for women in the future (stability of conditions for women). Specifically, the network is less likely to be perceived as useful to the collective when individual advancement is possible, and status improvement of the in-group in the future is unlikely. It is suggested

that this is because intergroup boundaries were perceived as permeable. However, regardless of beliefs about the future status of the group, when female participants perceived barriers to individual advancement, the network was seen as useful to the collective. It is suggested that this is owing to the impermeability of intergroup boundaries and the only way to challenge the status quo was through a collective effort.

2.2 Self-Categorisation Theory

Self-categorisation theory (SCT) is a pivotal component of the SIA, specifically focusing on the cognitive processes underlying social identification and the dynamics of group behaviour (Spears, 2011). SCT explains how individuals categorise themselves and others into groups, impacting their perceptions, behaviours, and interactions (Turner et al., 1987). The key mechanisms of SCT include social categorisation, in-group/out-group distinction, identity salience, depersonalisation and group norms and behaviours.

While social categorisation is one element of SIT, social categorisation is at the core of SCT, which refers to the cognitive act of classifying individuals into groups based on shared characteristics (Turner et al., 1987). This process is fundamental to how individuals interpret social information and navigate their social worlds. Individuals simplify complex social environments by categorising themselves and others, allowing for quicker judgements and decisions. The process of social categorisation provides cognitive shortcuts, such as race, gender, age and profession, which influence perceptions, attitudes and behaviours (Turner et al., 1987). For instance, individuals may rely on stereotypes associated with certain categories, leading to potentially biased judgements about in-group and out-group members.

Like SIT, SCT posits that social categorisation leads to the formation of in-groups and out-groups (Hogg & Terry, 2000). In-groups are groups with which individuals identify, while out-groups are those they perceive as distinct or separate (Tajfel, 1974; Tajfel et al., 1971). This distinction is crucial for understanding social behaviour, as individuals tend to

favour in-group members and exhibit prejudice toward out-group members (Haslam, 2004). The in-group/out-group distinction fosters a sense of belonging and identity among members of the in-group (Sindic & Condor, 2014). This phenomenon is supported by the idea of social identity, where individuals derive self-esteem from their group memberships (Haslam, 2004). Conversely, individuals may engage in negative stereotyping or discrimination against out-group members to reinforce their in-group identity and enhance their self-esteem (Hogg & Terry, 2000).

Identity salience refers to the prominence or importance of a particular social identity in a given context (Reynolds, 2012). SCT posits that the salience of identity can fluctuate depending on situational factors, such as the presence of in-group or out-group members (Oakes et al., 1994; Oakes & Turner, 1990). When a particular identity is salient, it becomes more influential in guiding behaviour and decision-making. For example, in certain contexts, an individual's gender identity may become more salient, leading to heightened in-group identification and bias against out-group members. Conversely, in a more collaborative context, individuals may prioritise their professional identity over their gender identity, fostering cooperation across group lines. This dynamic underscores the fluidity of social identities and the contextual factors that influence their salience (Sindic & Condor, 2014).

Depersonalisation is a key mechanism within SCT that describes the cognitive process through which individuals perceive themselves and others as interchangeable group members rather than as unique individuals (Hornsey, 2008). This shift in perception occurs when individuals categorise themselves into social groups, leading to a focus on shared characteristics and group norms (Sindic & Condor, 2014). Depersonalisation can facilitate group cohesion and conformity, as individuals may align their behaviours and attitudes with those of the group. However, it can also lead to negative outcomes, such as the dehumanisation of out-group members and increased intergroup conflict (Postmes et al.,

2005). The degree of depersonalisation can vary based on the strength of group identification and the situational context.

SCT emphasises the role of group norms in shaping individual behaviours within social contexts (Reynolds, 2012). Once individuals categorise themselves as group members, they become subject to the norms and expectations associated with that group (Haslam, 2004). These norms dictate acceptable behaviours, attitudes and beliefs, guiding individuals in their interactions with both in-group and out-group members (Sindic & Condor, 2014). For instance, individuals who identify strongly with a political party may adopt the party's stances and behaviours, even if they personally disagree with some aspects. This phenomenon highlights the power of group norms in influencing individual decision-making and social behaviour (Ibarra & Andrews, 1993; Lembke & Wilson, 1998).

SCT has profound implications for understanding various social phenomena, including prejudice, discrimination, intergroup conflict, and group dynamics (Reynolds, 2012). By examining the cognitive mechanisms that drive social categorisation and identity, SCT provides valuable insights into intergroup relations, organisational behaviour, social identity, and mental health and wellbeing (Bizumic et al., 2009; Haslam et al., 2000; Rink, 2007). SCT offers a framework for understanding the dynamics of intergroup relations, particularly in contexts of conflict and competition (Turner et al., 1987). The theory highlights the importance of social identity in shaping individual wellbeing. Strong in-group identification can enhance self-esteem and provide social support but can also lead to negative attitudes toward out-groups (Hogg et al., 1995). Understanding these dynamics can inform interventions aimed at promoting positive intergroup relations and individual mental health (Brook et al., 2008; Haslam et al., 2000; Hogg & Terry, 2000).

2.3 Limitations of the Social Identity Approach

While the SIA has garnered robust support, several limitations emerge, particularly concerning the practical application of its theoretical constructs. One significant challenge is the abstract nature of the language used within the SIA, making it difficult to draw clear connections between theoretical ideas and concrete behaviours in real-world settings. For instance, social identity salience (the conditions under which a social identity becomes prominent) is not well delineated, and the distinction between social and personal identity remains inconsistent. This ambiguity complicates efforts to understand when individuals act based on social identity versus personal identity, leading to variability in the theory's applicability across different contexts.

The context-specific nature of SIA further complicates measurement. Group identities are not static; they are activated under certain conditions and may remain dormant in others. This situational fluidity makes it challenging to measure social identity consistently, as an individual may not exhibit the same group-related behaviour across contexts. This problem is exacerbated when considering individuals who do not cognitively identify with a group, which can weaken the predictive power of social identity. An example of this limitation is the mixed evidence supporting self-esteem as a key mechanism within SIA. While self-esteem has been posited as a driver of intergroup behaviour, research such as that by Abrams and Hogg (1988) suggests that self-esteem only partially explains discriminatory behaviours. More recent work, such as by Hogg and Abrams (1990) and Hogg and Mullin (1999), even suggests that self-esteem may be a by-product of intergroup discrimination rather than a direct cause, complicating its role within the theory.

SIA's limitations are further underscored when applied to certain social phenomena. For instance, Rudolph and Hetherington (2021) sought to understand the extent to which affective polarisation was driven by in-group (in-party) love or out-group (out-party) hate and

the implications of this across contexts. Affective polarisation refers to the tendency of individuals who identify with a particular political party, such as Republicans or Democrats, to develop stronger positive feelings toward members of their own party (co-partisans) while harbouring increasingly negative attitudes toward members of the opposing party. A sample of 303 undergraduate students at a public university in the midwestern United States of America were surveyed to analyse partisan trust judgements. Rudolph and Hetherington (2021) found that affective polarisation was nearly twice as strong in political settings as in non-political settings.

Furthermore, while affective polarisation did reflect a blend of both in-party love and out-party hate in both contexts, in-party love is the more dominant source of polarisation in non-political settings, while out-party hate is the more dominant source in political settings. This later finding is of particular interest for social identity research because it questions how well-suited SIA is for understanding polarisation in the political sphere. Additionally, Howarth (2002) examined the social identities of young people living in a stigmatised area of South London and found that SIT provides a clear account of some aspects of identity construction but fails to be nuanced enough in a real-world setting. This suggests that, while SIT has been successfully applied and replicated across various social contexts, its effectiveness may be limited in certain environments. Specifically, the theory may only fully explain group processes and behaviour when group boundaries are well defined, or it may offer a partial understanding in contexts where group dynamics are more fluid or less clearly demarcated. While SIA provided some insight into identity construction, it failed to account for the nuanced and lived realities of identity formation in these communities. This highlights the need to further examine the theory’s applicability across diverse settings. In summary, while SIA has been successfully replicated in various social settings, its limitations become evident in contexts where group boundaries are not well defined or where social identity is

more fluid. These challenges underscore the need for further research to refine and expand the theory's applicability to diverse and real-world settings.

2.4 Conclusion

In conclusion, the exploration of the SIA, encompassing both SIT and SCT, has gained significant traction across diverse fields, including health behaviour research (Blondé et al., 2022; Feng et al., 2021), marketing research (Hudders & De Jans, 2022; Liang et al., 2021) and leadership research (Shore & Chung, 2023; Sims & Barreto, 2022). The application of these theories within the organisational context is of particular relevance to this thesis and will be explored in greater detail in the following chapter. The mechanisms of the SIA provide a useful overarching framework for understanding social dynamics through its explanation of the psychological mechanisms underpinning group interactions, consequently making it useful in the context of this thesis. The emphasis on in-group and out-group membership highlights the importance of acknowledging both individuals and groups, which is essential for a comprehensive understanding of social identity (Haslam et al., 2012). This theoretical foundation bridges the individual-society divide, providing insights into how social identities are formed and negotiated, once again shedding light on the psychological mechanisms associated with the professional identities of researchers. Similarly, social categorisation is vital in advancing social identity research by explaining the cognitive mechanisms that shape social behaviour. Its focus on social categorisation, in-group/out-group distinctions, identity salience, depersonalisation and group norms enriches our comprehension of intergroup dynamics. Although SCT has been validated across various contexts, ongoing research must refine its mechanisms and enhance its applicability in diverse social settings. As social dynamics evolve, the SIA will continue to serve as a critical framework for examining the intricate relationships between individual identities and group behaviour. In summary, while both SIT and SCT provide valuable insights into social identity

processes, further research is essential to fully understand their implications and applications across different contexts, particularly within organisational contexts and within the application of professional identities.

Chapter 3: Professional Identities and Roles

Now that the SIA has been outlined and explained, this framework will be used to explore professional identities and the corresponding professional roles associated with these identities. Professional identities are important because professional identities often influence a person's sense of self more than personal characteristics (Hogg & Terry, 2001), and an individual's professional identity is often the most significant identity in their life (Adams et al., 2006). Researchers possess a clearly defined professional identity (Carlone & Johnson, 2007) that is deeply embedded in the principles of science (Ecklund & Long, 2011). One key area where researchers are expected to enact this professional identity is through the communication of science. Researchers are increasingly expected to engage more frequently in science communication because, logically, they are the experts most qualified to communicate their research (De Boer et al., 2005; Weigold, 2001). However, engagement in certain forms of science communication (advocacy-type communication) may contradict some researchers' professional identities and what they consider their professional roles to be as researchers (Besley & Nisbet, 2013). Therefore, there is a need to understand how researchers identify themselves in a professional capacity (Rosenblum et al., 2016) and the subsequent effects that this identification as a professional researcher has on the communication of scientific information and engagement in advocacy-type communication styles (Côté & Darling, 2018).

This chapter opens with a description and definition of professional identities and roles and different perspectives in understanding how professional identities develop. It then explores the identified factors affecting professional identity development and the notion of changing professional identities. Because identities and roles can be conceptualised as 'two sides of the same coin', this chapter integrates the discussion of roles with the discussion of identity. The chapter ends with a description of researchers' professional identities as

outlined within the current literature and a brief link back to the SIA. While there is literature examining researcher, science, academic or STEM professional identities, to obtain a complete picture of the professional identity literature, it may at times be necessary to step outside these bounds and discuss other discipline-specific studies.

3.1 Professional Identities

The identity activated within a professional setting can be considered an individual's professional identity (Ibarra, 1999). A professional identity is a stable and persistent collection of values, beliefs, attributes, motives, and experiences from which people define themselves in a professional setting (Ibarra, 1999) and are, by their nature, socially constructed (Erikson, 1968). Therefore, an individual's professional identity is the awareness of the job they do (e.g. conduct research, engage in science communication), their identification within this workgroup, and social categories that are associated with the job (being teachers and researchers; Mancini et al., 2015). Mancini et al. (2015) suggest that identities are activated by situational cues, such as the professional environment in which someone is working. Mancini and associates then describe a professional identity as an individual's awareness of their job, their social identification within this work group and social categories associated with the job, aligning with SIT within the SIA.

Furthermore, professional identities are group-based identities because they are shared with a group whose members have characteristics in common (Ashmore et al., 2004). The development of a professional identity relies heavily on social identities (discussed in the previous chapter) because an individual's identity is developed based on the various meanings attached to a person, not just by themselves but also by others. Therefore, professional identities can be conceptualised as an individual's social identity in their professional setting. An individual's professional identity is classified as a social identity as opposed to a personal identity, as there are characteristics within this identity that are true for

most individuals within that professional group. Furthermore, this notion of social identity rather than personal identity is because an individual's identity is a personal construction that is developed through an amalgamation of the individual identifying with other specific groups or individuals while also being a social construction, which is developed through the internalisation of specific roles and the appraisals of others (Erikson, 1968).

Identities and roles, particularly in the professional capacity, are two concepts that are hard to separate. Role and identity are two sides of the same coin, where roles look outwards at the interactions of specific situations. In contrast, identity is inward-focused, enabling people to enact their roles through their subjective experience of a situation (Barley, 1989). A role is defined as 'a behavioural repertoire characteristic of a person or a position; a set of standards, descriptions, norms or concepts held for the behaviours of a person or social position; or (less often) a position itself' (Biddle, 1979, p. 9). Role and identity are not constructed independently of each other; instead, a relationship between the two exists (Chreim et al., 2007). Much of the literature discusses that an individual can have different identities depending on context (professional identity), with very little acknowledgement of the associated roles with these identities.

However, individuals can also have multiple roles within a single identity. For example, an individual may find themselves portraying different roles in the course of enacting their professional identity, such as a researcher who fills the formal structural role of a manager but also plays the role of a scientific expert and science communicator. Each of these different roles can carry specific expectations relevant to that specific role, such as behaviours, speech and attire. These roles that people portray may or may not be within the confines of a traditional definition of what it means to be a professional researcher. They may be influenced by the individual's interpretation of the situational context, their own sense of

self or expectations of others (Hatmaker, 2012). A specific role may be applied only to a certain setting or can be diverse and apply across various settings.

Professional identities and roles are important because they indicate collective norms, values and rules and afford group-specific social symbols (Bayerl et al., 2018). Professional identities and roles can be used to understand and explain why people act and behave in a particular way in their professional setting. For instance, they can be used to understand why some researchers choose to engage in advocacy-type science communication and why others do not. This is because identity and the corresponding role are a set of meanings that help shape and define who an individual is when they are inhabiting a certain role in society, when they are members of a particular group, or when they claim certain characteristics that identify them as a unique person (Burke & Stets, 2009). Professional identities and roles also provide individuals with a blueprint for how to act and behave in particular situations (Johnson et al., 2006). These blueprints are developed through a complex process that has been the subject of much empirical research and is discussed throughout this chapter.

3.2 Key Perspectives in the Development of Professional Identity

There is a lack of clarity around the underlying mechanisms that facilitate the development of an individual's professional identity. This lack of clarity arises from the multiple perspectives that have been applied to understand these mechanisms. It is important to emphasise that these perspectives should not be viewed as independent or competing. Rather, these are more complimentary explanations of identity development. The first of these is a learning perspective. From this perspective, it is suggested that the successful development and maintenance of professional identities is interwoven with the process of learning what is required of the profession. For example, Clarke et al. (2014) examined how occupational therapy students experienced and ascribed meaning to role-emerging placements (placements that occur at sites without an established occupational therapist role).

Using interpretative phenomenological analysis of five Master of Science pre-registration occupational therapy students, results indicated that role-emerging placements were strong catalysts for the students' ontological development. Suggesting that their understanding of themselves and the development of their way of being as an occupational therapist resulted from being immersed in the learning context of placements. By engaging in challenging and independent learning experiences, the students developed a deeper insight into who they were becoming as professionals, leading to the development of their professional identity. The learning process is not limited only to placements; it can also occur in primary school children (Schmitt-Wilson & Welsh, 2012), undergraduate students (Ashby et al., 2016) and postgraduate students (Mantai, 2017).

The learning perspectives highlighted within this literature focus on the interplay between learning the requirements of the discipline and embodying these learnings to identify with this profession. While this learning perspective does not specifically focus on the social elements of professional development, it could be argued that learning the roles and requirements of a job within this learning perspective are inherently socially derived and created. The learning process is a social process because individuals are not learning the application of their training in isolation. They are, in fact, engaging in a social learning process by modelling behaviours and reflecting on their interactions with others to understand the quality of their role performance. Therefore, separating a learning perspective from a socialisation or developmental perspective may not be entirely useful. Indeed, research into the development of roles also supports this notion as roles develop from sharing *expectations* of behaviours within certain contexts (Biddle, 1979). For example, individuals who engage with a specific role do so because they have learned what behaviours are expected of them, while others engage with the normative role behaviour owing to the expectation placed on them to teach and enforce the appropriate role behaviours.

The second perspective, social network theories, focuses on the social aspect of professional identity development. Social network theories (or developmental networks) draw on this social element to understand the development of professional identities (Biddle, 1979). Social network theories explain how a network of individuals establishes and maintains connections within an organisational context and how those connections can enable many outcomes (Biddle, 1979). Such outcomes include professional advancement, information acquisition, and identity development (Ibarra, 1999; Ibarra et al., 2005). Research has demonstrated that an individual's social network can be seen as a mechanism to facilitate the construction of identity (Ibarra et al., 2005). Indeed, this is evident within the SIA, given that social networks are characterised by relationships within groups, which are maintained by expectations of trust and reciprocity. The strength of these relationships can then create in-group/out-group dynamics, given people's preferences to work with those with trusting and reciprocal relationships.

The notion that individuals construct their identities through the development of their networks has been supported by research such as Dobrow and Higgins (2005). This study examined the influence of developmental network relationships on the professional identity development of 136 MBS students longitudinally. Dobrow and Higgins (2005) used two development network characteristics: social relationships from multiple contexts or a single context, and access to useful or unhelpful sources of information. Through multiple regression models, Dobrow and Higgins (2005) found that as an individual's development network increased, how clearly they viewed their professional identity also increased. This directional strength of professional identity development suggests that having a social network of individuals relevant to your profession helps strengthen and helps inculcate an individual into the profession faster, possibly through the shared understanding of group norms. This research also suggests that professional identities are developed through social

networks and that this social element helps shape and foster the development of professional identities. This supports the socially constructed nature of professional identities by highlighting the connection between the social dimensions of learning and developing a strong professional identity.

It is evident that these two perspectives, learning and social, are complementary and mutually reinforcing. These findings suggest that the socialisation process affords participants a higher number and quality of network connections which means that individuals have more opportunities to learn from others in their profession. This complimentary perspective is supported by the research conducted by Adams et al. (2006), which is discussed in more detail in the next section.

3.3 Key Mechanisms Facilitating the Development of Professional Identity

The development of an individual's professional identity has been broadly researched. However, most of these studies are discipline specific and focus on what a professional identity is, how it develops and how to further enhance professional identity development within students of specific disciplines. These studies tend to provide a list of factors or suggestions for education programs that increase identification with their desired professions. Owing to the limited number of psychological studies investigating the development of professional identities across disciplines, this section will describe in detail one study, Adams et al. (2006), and use the literature from other fields to support or refute these findings.

Adams et al. (2006) aimed to investigate the strength of professional identity when students began their professional studies, the differences in the strength of professional identity between students from different professions and different factors that may have contributed to the original strength of professional identification. Health and social care students from two universities in the south of England were recruited with 1,254 students participating. A total of 10 professions were represented (Audiology [2%], Medicine [14%],

Midwifery [1%], Nursing [48%], Occupational Therapy [6%], Pharmacy [10%], Physiotherapy [6%], Podiatry [3%], Radiography [5%] and Social Work [5%]). Data for this study were collected by questionnaire. The dependent variable (professional identity) was measured using a professional identity scale developed by Brown et al. (1986), adapted to suit a health and social care student population and specifically measured group identification. The independent variables were selected based on theory and empirical research by Adams et al. (2006). These included demographic variables (age, gender and profession) and other variables such as cognitive flexibility, self-reported knowledge, team understanding and prior team-working experience, prior work experience and number of family members within the health and social care profession. An ordinary least squares regression model was used to test the associations between the independent variables and professional identity.

Adams et al. (2006) found several factors that supported professional identity development, which were consistent across the different disciplines investigated. Identification with a specific profession was strongest amongst those students with greater cognitive flexibility (a greater ability to structure knowledge), those with previous work experience in health and social care environments, those with a better understanding of team-working, and those students with a greater self-reported knowledge of their own profession. These findings highlight that developing a professional identity is not about how much an individual objectively knows but what they think about their profession. These findings further support the previously discussed notion that professional identities develop through a complementary process of professional socialisation and professional learning.

Gender was also found to be a predictor of baseline professional identity, suggesting that gender stereotypes in conjunction with feminine and masculine traits have implications for the ways in which professional identities are acted out (Adams et al., 2006). Demographic

variables such as age, the number of family members in health and social care and previous team experience did not affect professional identity. Adams et al. (2006) used *group identification* as a measure of professional identity and asserted that gender stereotypes, together with masculine/feminine traits, have implications regarding *intergroup relations*, highlighting the relevance of using the SIA as a lens through which to view professional identities.

3.3.1 Cognitive Flexibility

Cognitive flexibility examines knowledge acquisition and is defined as an individual's ability to adaptively re-assemble diverse elements of knowledge to fit the specific needs of a certain situation (Spiro, 2012). Cognitive flexibility can be understood as an individual's ability to construct knowledge in response to shifting situational demands. It refers to 'a person's (a) awareness that in any given situation there are options and alternatives available, (b) willingness to be flexible and adapt to the situation, and (c) self-efficacy or belief that one has the ability to be flexible' (Martin & Anderson, 1998, p. 3). According to Adams et al. (2006) professional identity was strongest amongst students with greater cognitive flexibility. The finding by Adams et al. (2006) suggests that individuals with greater cognitive flexibility are more adept at adopting roles and developing their professional identities. This finding is especially applicable when considering the progression of students from novices to experts, a process shaped by the ongoing development and construction of knowledge specific to their profession (Martin & Anderson, 1998). Therefore, researchers who have greater cognitive flexibility may find it easier to adopt the role of a researcher and may find it easier to structure their professional knowledge in response to changing situational demands because cognitive flexibility allows the researcher to adjust the boundaries of their roles without threatening their sense of identity (such as determining the type of science communication they are comfortable engaging with).

3.3.2 Prior Work Experience, Training and Educational Pathways, and Self-Efficacy

Individuals with previous work experience in health and social care environments had the strongest professional identity compared with participants without work experience (Adams et al., 2006). Other studies have also indicated that skills and knowledge acquisition, including research apprenticeships, affect the strength and development of a researcher's professional identity. For instance, Nadelson et al. (2017) studied undergraduate STEM students enrolled in a large metropolitan university in the United States to explore the development of STEM students' professional identities. They interviewed 20 STEM students to assess the relationship between undergraduate STEM students' self-identification as professionals and their learning preferences, educational experiences, and interactions with other members of the professions (faculty members). The results found that the students who engaged in learning activities that resembled activities of STEM professionals developed a stronger sense of STEM professional identity. These results show that the skills and knowledge acquisition through discipline-specific learning experiences may lead to higher levels of professional identities in researchers. Therefore, more knowledge about the profession and a greater understanding of the norms and roles of the profession make an individual see themselves within that profession more easily.

In line with research by Nadelson et al. (2017), Park et al. (2018) studied the process by which Asian STEM graduate students at a large research university in the United States engaged with graduate studies as they built their professional identities. Park et al. (2018) developed a central professional identity development model that indicated that previous work experience, relationships with faculty advisers and peers and disciplinary skill acquisition were significant influential factors in the participant's professional identity development. These influences interacted to promote the development of professional identity among students with prior work experience, strong socialisation with peers and

faculty advisers, and robust acquisition of disciplinary skills. Conversely, progress toward professional identity development was impeded for students lacking access to these interactions and experiences.

In other research by Mantai (2019a), researchers explored the shift from doctoral identities to academic identities of 15 doctoral students from two large Australian universities who were approaching thesis submission and aspired to become academics. Using a qualitative longitudinal study design and narrative inquiry, Mantai (2019a) found two contrasting stories about how academic identities were developed and experienced. The students described their identities and evaluated their educational development in relation to their perceived value within academia. To increase their employability, the students focused on networking and engaged in university teaching. The students regarded researcher development as the main focus of their doctoral studies. However, this was considered insufficient for a career in academia as they felt they would not adequately develop a researcher identity without other training factors. Mantai (2019a) suggested that to strengthen researcher identity development, doctoral education needed to encompass a wider range of elements, including supporting non-academic work experiences and teaching. However, while research such as this may be conceptualised by some as individuals holding different professional identities (i.e. the researcher, the lecturer/teacher, the administrator), it could also be conceptualised as an individual holding one professional identity with many different professional roles that are embedded within this identity. This point is not often discussed within the literature.

There is considerable overlap between perceived knowledge and experience and self-efficacy. Self-efficacy is an individual's belief in their capacity to implement the behaviours necessary to achieve their goals, which is essentially confidence in the skills they have acquired via knowledge and experience. Although self-efficacy was not identified in Adams

et al.'s (2006) study as a factor influencing the development of professional identity, it has been identified in other studies. For instance, Estrada et al. (2011) tested whether a three-part integration model of social influence suggested by Kelman (2006) could predict the integration of minority students into the scientific community. Kelman's (2006) model predicted social influences by which a person orients to a social system and suggested three processes of social influence (compliance, identification and internalisation) defined by unique antecedents and consequent conditions. Estrada et al. (2011) collected longitudinal data from minority science students (n = 1,053) from 50 universities across the United States. SEM showed that self-efficacy predicted students' intentions to pursue a scientific career. However, self-efficacy became a poorer predictor of intention when internalisation of values and identification as a scientist were added to the model. Further mediation analyses supported the conclusion that while having scientific self-efficacy was important, identifying with and endorsing the values of the scientific social system reflected a deeper integration and more durable motivation to persist as a scientist. This suggests that although education, knowledge and experience all help with developing a professional identity, the more important predictor is professional socialisation acquired through teaching individuals about the values and roles of the profession.

The development of a professional identity has been viewed as the process of enculturation into discipline-specific practices. For example, Berkenkotter et al. (1988) described the life of science graduate students as a process of being initiated into a research community. This initiation process was through disciplinary reading and writing practices, instruction in research methodology and interactions with faculty and peers. They concluded that graduate students' experience through their graduate program was an enculturation process affecting their professional identity development. This identity development begins during schooling, with the learning of science viewed as a process of acquiring an

understanding of science and applying this understanding in new situations through the process of cognitive flexibility (Brickhouse et al., 2000). From this perspective, identity development goes hand in hand with learning, which supports the learning perspective of identity development discussed earlier.

Further support for the learning process of identity development is evidenced by Quartiroli et al. (2021), who undertook a systematic review of professional identities among sports psychology practitioners. The researchers identified four main areas relating to the formation of professional identities within this field: (1) training and educational pathways, (2) developing competence and knowledge, skills and abilities for practice, (3) developing the role and purpose of a sport psychology practitioner and (4) the 'self' as a performer. This systematic review of 25 articles identified training pathways and continuing education as important components affecting and influencing the development of professional identities. Results suggested that individuals viewed their training as being intrinsically linked with the beginning of their professional development and, as a result, provided them with an avenue to develop and explore their professional philosophy. Furthermore, theory-focused education was not enough to provide individuals with the skills necessary to navigate their professions. Instead, they required the ability to learn through their own practice, reflect on their practice and gain the guidance of their supervisors. Interestingly, these findings not only support a learning-based perspective on identity development but also highlight the critical role of socialisation in shaping professional identities.

While the socialisation process in professional learning is key to professional identity development, so too is the learning process more broadly. Ligorio (2010) explained this relationship between learning and identity development based on the general framework of sociocultural constructivism. From this perspective, identity is closely dependent on context and is an outcome of a knowledge-building process. Moreover, identity formation implies a

trajectory that connects an individual's past, present and future (Jørgensen & Keller, 2008). This means that identities are continuously negotiated as individuals progress throughout their lives and that identity reflects past experiences, present times and future ambitions. This demonstrates that having previous work experience in the area may indicate that individuals can identify with the profession earlier in their lives and begin to think like one of these professionals earlier. While education, knowledge and experience help develop a professional identity, the more important predictor is professional socialisation.

3.3.3 Prior Knowledge of the Profession and Professional Socialisation

Adams et al. (2006) found that professional identity was highest amongst those students with a greater knowledge of their own profession. This finding is supported by research into professional socialisation, even though Adams and colleagues caution against their findings owing to the self-report nature of their study. Professional socialisation is a complex process through which a person acquires the knowledge, skills and sense of professional identity that are characteristic of a member of that particular profession (du Toit, 1995). Many studies, including Quartiroli et al.'s (2021) systematic review, have supported the importance of professional socialisation to the development of professional identities (Hunter et al., 2007; Hunter & Cook, 2018; Price et al., 2021).

For example, Ashby et al. (2016) explored students' perspectives on the way in which pre-entry experiences and curricula content shaped the professional identity of occupational therapy students. A cross-sectional self-report survey was sent to students enrolled in their final year of entry-level programs from five English-speaking countries (Australia n = 88, Canada n = 32, Ireland n = 5, UK n = 37 and USA n = 156). The study found that students who participated in professional education and professional socialisation during placement had a stronger sense of being an occupational therapist (professional identity) than those students who did not. The students in Ashby et al.'s study also self-reported that pre-

programmed exposure to somebody within the profession (professional socialisation) at either a professional or personal level was the starting point for them in identifying with the profession. The authors conclude that educational facilities that provide opportunities for workplace visits prior to the commencement of a programme can create an early connection with the profession's values and beliefs and reinforce career choices within the individual. According to Ashby et al.'s results, this exposure appeared to have a greater influence on graduate entry master's students, who were more likely than undergraduate students to perceive that it influenced their professional identity formation. The results found by Ashby et al. (2016) reinforce and is supported by the findings from several previous studies, which highlighted the important role that practical components in curricula play in shaping students' attitudes, knowledge, beliefs, values, skills and understanding of their roles (Quartiroli et al., 2021; Rodger et al., 2008; Towns & Ashby, 2014) but also provides evidence on the importance of professional socialisation.

Professional socialisation is achieved through engagement with mentors, support systems or role models. For example, Hernandez et al. (2017) assessed a novel theory-driven informal mentoring program, PROGRESS (PROmoting Geoscience Research, Education and Success), which aimed to support first- and second-year female STEM majors. Mentoring and persistence outcomes for women in and out of the PROGRESS program were assessed longitudinally across seven universities in the United States using a score-matched design of 116 participants ($n_{\text{PROGRESS}} = 58$ and $n_{\text{control}} = 58$). The longitudinal design allowed the researchers to determine whether engagement in the PROGRESS style workshops enhanced women's scientific mentor network and ascertain the degree to which mentoring support enhanced women's scientific identity development, future STEM career motivation and persistence or intentions to continue within a STEM career. Participants completed an online matching survey that measured academic interests and achievements, psychological and

motivational factors associated with persistence in STEM (for instance, science self-efficacy) and interest in having a mentor. Interest in participating in a longitudinal study was also measured. In the experimental group (PROGRESS group), participants were invited to participate in a weekend workshop. In these workshops, participants learned how to communicate with mentors, gained access to a network of potential mentors to broaden their support network, had exposure to female role models from diverse careers, discussed the challenges women in STEM disciplines face during undergraduate courses and discussed ways to combat the potential gender biases seen within these disciplines. After the workshop weekend, those in the experimental group were connected with mentors from their home region and encouraged to meet semi-regularly to maintain support. In the control condition, participants did not participate in the weekend workshop and only received mentoring support typically provided within the university context.

Hernandez et al.'s (2017) results indicated that women in the PROGRESS program had larger networks of mentoring relationships and mentoring support than matched controls. This result is not surprising, given the amount of mentoring support that was provided to participants. However, the results did show the benefit of these support systems in strengthening the scientific identity of early undergraduate women and their interest in earth and environmental science career pathways. Further, mentoring had a positive indirect impact on women's intention to persist in science by strengthening the development of their scientific identity. Indeed, these results support findings from Young et al. (2013) who highlight the importance of female role models on female participation in STEM. Taken together these results suggest that the process of developing a professional identity is dependent on existing role models to help the novice find the appropriate identity.

The socialisation process is critical in assisting an individual in developing an understanding of what it means to be a professional in a specific context and moving beyond

an idealised version of the professional identity. This involves an individual recognising their new identity as a member of that profession (becoming members of the professional in-group) and may depend on the existence of role models to help the novice establish their identity within the profession. Robnett et al.'s (2018) research supports this by studying the link between three forms of mentoring (instrumental, socioemotional and negative) and the degree to which undergraduates psychologically identify with science. Instrumental mentoring was operationalised as task-focused mentoring, which involved providing the student with the skills and resources to help them succeed; socioemotional mentoring involved providing the student with social and emotional support; and negative mentoring was when the mentor engages in practices that undermine the mentoring bond, for example, a mentor who provides demeaning remarks about the students work or continually cancels meetings. Participants (n = 66) who were involved in the undergraduate–mentor pairs that worked together in a research apprenticeship completed a survey that assessed their scientist identity and the mentoring they received. The sample predominantly consisted of undergraduate female students who were first-generation college students and members of ethnic groups that were historically underrepresented in science. The study's results highlighted an association between scientist identity and the three different forms of mentoring. These findings demonstrate that undergraduate students who reported receiving more instrumental and socioemotional mentoring had a more clearly established scientist identity. Additionally, mentors who reported engaging in higher levels of negative mentoring produced undergraduate students with less clearly defined scientist identities. This study supports the notion that role models act as key facilitators in the professional socialisation process and the development of professional identities.

3.3.4 Gender

Gender is an important and complex factor affecting the development of professional identities. Additionally, gender further demonstrates the link between the SIA and professional identities, where the socially constructed nature of gender affects other socially constructed and mediated constructs, such as identity development. An individual's gender identity is a strong and ever-present identity that is often clearly recognisable regardless of context. Gender identity has social norms and expectations ascribed to it, which at times may affect or interfere with the development of professional identities, particularly those that appear to contrast with the social norms associated with gender. Indeed, the gender stereotypes associated with certain professions were found to be a predictor of baseline professional identity in the research conducted by Adams et al. (2006).

Similar findings were found by Du (2006), who used qualitative interviews to research engineering professional identity at a Danish university. Du's (2006) research aimed to examine the learning experiences of male and female engineering students in problem-based and project-organised learning environments. Based on a qualitative comparative case study of two engineering programmes, Du found that there were different learning experiences for male and female students. The different learning experience was a result of the culturally defined nature of engineering competencies and the association of an engineering identity with masculinity. The nature of engineering subjects was based on male interests (e.g. construction), privileged men and acted as a barrier to women. The findings of Adams et al. (2006) and Du (2006) suggest that gendered stereotypes, together with masculine/feminine traits, have implications regarding intergroup relations and, hence, the way professional identity is learned through professional socialisation. These findings suggest that how strongly men and women identify with their professional identities differs between genders, but that they may also experience professional identities qualitatively

differently (Adams et al., 2006). However, the link between gender and professional identity, according to Adams et al. (2006) and Du (2006), was understood in terms of professional identity determined by gender engagement (e.g. the professional identity was masculine and excluded women).

Whereas in research by Pierrakos et al. (2010), it was suggested that gender determined professional identity, with males and females identifying with professions differently, leading to differences in professional identity. Surveying first-year engineering students, Pierrakos et al. (2010) aimed to provide insight into the development of an engineering identity. Survey items comprised open-ended questions that were developed based on prior interview data. A comparative analysis of male and female responses revealed that students' gender and prior exposure to engineering activities influenced male students to perceive engineering as a hands-on profession, while female students approached it from a more abstract and theoretical perspective. These findings have potential implications for the development of professional identities and can be examined further through the lens of the dissonance between actual and idealised professional identities or even role conflict.

Gender has also been found to contribute to a marginalisation of an individual's professional identity while overly validating their gendered identity. For example, Hatmaker (2013) considered how women in a gendered profession (engineering) constructed their professional identities in response to workplace interpersonal interaction that marginalised that identity. Interviewing women engineers (n = 52) in the United States, the study explored how these interactions influenced the engineers' sense of self and belonging in engineering. The results found that interpersonal interactions placed professional identity on the periphery and overly validated gender identity. That is, the women experienced workplace interactions that conferred a status based on being a woman rather than an engineer. The results suggest

that gendered norms and stereotypes are much more difficult to have others overcome and to view an individual as something ‘other’ than their gender.

Hatmaker (2013) identified four ways interpersonal interactions marginalised participants’ professional identities: (a) by amplifying gender, (b) by imposing gendered expectations, (c) by tuning out and (d) by doubting technical abilities. The results also suggested that the participants employed two types of identity construction strategies in response to these marginalising interactions: impression management tactics and coping strategies. Hatmaker’s (2013) results demonstrated that participants may be left feeling devalued or ambivalent towards their identity or their fit within the engineering profession. However, some women experienced interactions that were validating and did offer a sense of belonging, such as being recognised by their peers as technical experts or publicly receiving a formal award. These results highlight the important and complex interaction between gender and professional identity.

The complex interaction between gender and professional identities is further emphasised in another study by Hatmaker (2012). Specifically, the study found that when constructing their identity, many women within engineering actually embraced the stereotypical characteristics of belonging to a woman's gendered identity, further emphasising rather than downplaying their gender. However, what is not clear from these findings is whether this is an emphasis on gendered identity or a refusal to sacrifice, diminish or hide their femininity because being a woman is not relevant to being an engineer. It could be conceptualised that women in this study perceived they could hold and maintain both identities—their gender and professional identities. Consequently, the study results may instead reflect that the women were not emphasising their gender identity but rather simply not downplaying it.

3.4 Changing Professional Identities

An individual's professional identity may not be consistent throughout their lives (Bruner, 2004; Burke & Stets, 2009; Jørgensen & Keller, 2008). Job roles change and evolve, or individuals choose to change their careers which may require individuals to adapt or change their professional identity. The process of shifting professional identities, particularly when the change in job role is imposed rather than voluntarily chosen, can present significant challenges for individuals. This difficulty is heightened by the fact that professional identity often constitutes one of the most central and salient aspects of an individual's overall identity. Chen and Reay (2021) attempted to understand this by developing a process model of professional identity restructuring that included four stages: (1) resisting identity change and mourning the loss of previous work, (2) conserving professional identity and avoiding new work, (3) parking professional identity and learning new work and (4) retrieving and modifying professional identity and affirming new work. These four stages reflected the stages that individuals moved through as they transitioned from their previous professional identity to a new one. This research demonstrates that professionals who are required to change elements of their work role may be able to move through this series of transitions where the relationship between the specifics of the work and professional identity can be temporarily severed. These results also suggest that the motivation to move from one stage to the next changes. For example, individuals moved from stage one to stage two because of a desire to protect their identity. They moved from stage two to stage three because they felt managerial pressure to do so. Lastly, they moved from stage three to stage four because of the encouraging feedback they received from stakeholders. This research suggests that professionals can briefly untangle their work roles and identities and then recombine them later as they master their new work roles. Through this mastery of new tasks, professionals

can see value in their new work and then begin to reconceptualise their professional identities.

In contrast, Ibarra and Obodaru's (2016) research suggests that it would be more beneficial for people to integrate their new and old identities at the onset of change rather than focusing on one of the identities during change. Chen and Reay (2021) suggest that established professionals may not easily contemplate these types of integrations, while individuals with dual identities may be better able to adapt to change (Berry et al., 2006). Established professionals are typically firmly situated in their identity, and therefore, Chen and Reay (2021) propose that such professionals can best navigate the change one step at a time. However, again, there is no clear differentiation between identity and roles within this body of research. Therefore, it may be that the participants' work roles are changing but not their professional identities, suggesting that these two concepts (identities and roles) are inexplicitly linked.

3.4.1 Role Ambiguity and Role Conflict

Role ambiguity and role conflict are two concepts that can have several implications for professional identities, affecting the development and maintenance of an individual's professional identity. Role ambiguity is defined as the degree to which clear information is lacking regarding (a) the expectations associated with a role, (b) methods for fulfilling known role expectations and/or (c) the consequences of role performance (Dunnette, 1976). For example, instances where single or multiple roles that an individual encounters may not be clearly articulated in terms of behaviours or the performance levels expected. Role conflict is defined as incongruency of the expectations associated with a role (Van Sell et al., 1981). Role conflict can lead to identity interference, which can occur when the pressures of one identity interfere with the performance of another identity (Van Sell et al., 1981). For example, Settles (2004) found that a female science student who feels that she needs to de-

emphasise her gender in the classroom to fit in with her male peers is experiencing gender-scientist identity interference in that her female identity cannot be expressed when enacting her scientist identity. Settles (2004) also found that women scientists who experienced interference in an undergraduate and postgraduate context between their gendered and scientist identities tended to report lower science performance and psychological wellbeing. Furthermore, individuals are frequently confronted with situations in which they may be required to play a role that conflicts with their value systems or two or more roles that conflict with each other. Role conflict has been linked with workplace stress, increased rates of workplace accidents and resignations, decreased organisational commitment and poor job performance (Anglin et al., 2022; Biddle, 1986; Chen et al., 2020; Choi & Sung, 2014; Sabanciogullari & Dogan, 2015).

It is important to recognise that a dissonance may be experienced between the idealised version of a profession and the real work undertaken by existing members of that profession. Indeed, this was seen in the previously discussed study conducted by Ashby et al. (2016), in which 64% of the 319 students (from each country surveyed) identified discrepancies between their expectations of occupation-based practice and what they actually experienced during their practice-based education. A similar dissonance was seen between expectations and practice education experiences in a US study by van den Heever (2014). It has been suggested that one avenue for alleviating this dissonance is through the professional socialisation process (Ashby et al., 2016), which facilitates understanding and adoption of the values and norms fundamental to knowing and understanding the profession. It seems that there is a dissonance between an individual's idealised version and the real version of their professional identity and that individuals may hold or be expected to hold different professional identities. This literature is often discussed in terms of identities and roles without a clear discussion about whether it is a single identity with multiple roles being

discussed or if it is different identities that all have different roles associated with these identities. Furthermore, the literature identifies two related concepts, role conflict and role ambiguity, which may help explain the dissonances seen within identities and help explain the relationships previously discussed between gender identity and professional identity.

While it is well established that individuals hold many different identities within their lives, it has been suggested that this is also true within their professional identity. For instance, the literature suggests that researchers' professional identities encompass many elements, such as academic, teaching and research (Chemers et al., 2011; Hancock & Walsh, 2016; Laiho et al., 2020). Barnard (2019) also explored multiple identities by investigating the researcher identity of four senior women academics in a South African institution of higher education who researched within the behavioural sciences. They aimed to uncover the identity tensions these women experienced in relation to being a researcher and to understand how they responded to and resolved these tensions. The data were collected using three focus groups. The participants in these groups participated in social dream drawing, which is a qualitative socio-analytic research method used in groups for studying identity providing a space for reflective thinking. The data were analysed through hermeneutic phenomenological reflection, and identity theory was applied as a conceptual framework to guide data interpretation.

Through the collective reflection of identifying as researchers, the results indicated that identity tension was evident between specific identity bases (a) between their work, social, and research identity, (b) within their work identities (researcherhood identity) and (c) between their personal identity and researcher identity (Barnard, 2019). The implications of these identity tensions are multifaceted and have significant consequences for professional identity development, particularly in relation to role conflict and role ambiguity. First, tensions between work, social and research identities suggest that individuals may struggle to

reconcile their professional responsibilities with their social roles and research commitments. This can lead to role conflict, where competing demands create internal or external pressures that complicate professional identity formation. Second, tensions within their work identities, specifically within the realm of 'researcherhood identity,' indicate potential conflicts between different aspects of their professional roles. For instance, the demands of teaching, administration or other professional duties may compete with the expectations and self-concept tied to being a researcher, leading to ambiguity and difficulty in fully committing to a clear professional identity.

Finally, tensions between personal identity and researcher identity point to challenges in aligning one's core personal values, beliefs or lifestyle with the expectations and demands of the researcher role. This tension can cause discomfort, dissatisfaction or uncertainty in professional development, as individuals may feel a disconnection between their personal sense of self and the identity they are expected to embody as researchers. Overall, these tensions underscore the complexity of professional identity development, revealing the struggles individuals face in integrating multiple and sometimes conflicting identities into a coherent professional self. Addressing these tensions is crucial for fostering a more cohesive professional identity and reducing the negative impacts of role conflict and ambiguity. Importantly, Barnard (2019) did not suggest or discuss other variables that may have contributed to the participants' work identities, nor did they discuss the interactions between roles and identities.

Role conflicts are particularly important to understand in professional or organisational contexts because although individuals do hold professional identities, they may more strongly identify with other non-professional aspects when they are in a professional setting (Johnson et al., 2006; Lee et al., 2015; Yong et al., 2020). For example, professionals may identify more strongly with their profession than with their employing

organisation, producing potential conflicts between professionals and the organisation's expectations for their behaviour (Ashforth et al., 2008). Second, professionals may be more committed to their profession than their employing organisation, potentially leading to greater turnover and fewer pro-social organisational behaviours (Miscenko & Day, 2016). An example of role conflict within the professional setting can be seen in research conducted by Johnson et al. (2006), who surveyed veterinarians working in a wide range of organisations to compare how their identification differed between veterinary profession, their organisation and their workgroups. Their results indicated that owners of veterinary medicine organisations identified more with the organisation than with the profession or the workgroup.

In comparison, veterinarians in non-veterinary medicine organisations identified more with the profession and their workgroup than with the organisation. Johnson et al.'s (2006) research indicates that professional identities are not stagnant or stable; they are fluid and subject to change, often as people progress throughout their careers. This fluidity of identity is because people learn and develop as professionals as they transition through their careers; they change their opinions and perspectives of their professional roles as they learn and develop. Functionally, their professional identities change—their professional identities no longer align because they are no longer practising in their professional roles anymore and are instead practising roles that align with a different professional identity of a manager or a business owner. This highlights the strong link between identity and roles and that one cannot be considered in isolation from the other.

Role conflict and role incongruency can also affect the maintenance of or changes to a professional identity. This impact can be seen in change initiatives within organisations. For instance, when facing imposed changes, professionals often avoid adopting work practices that do not fit their identity, making implementing change initiatives difficult (Reay &

Hinings, 2009). An example of role conflict can be seen in areas such as the role conflict between teaching and research (Jawitz, 2009; Laiho et al., 2020; Neumann, 2001), where the engagement in teaching runs at odds with their researcher identity and may cause role conflict or role incongruency to form. Role conflict has also been seen in the shifting nature of academic work and the effect of this on academic identities within higher education (Archer, 2008a; Clegg, 2008). However, as previously discussed, professionals can change their identity jointly with changes in their work when they believe the new work is valuable (Ibarra, 1999; Kyratsis et al., 2017). This often occurs as part of professional advancement, such as when doctors learn to become specialists (Pratt et al., 2006). However, with the changing and dynamic nature of professional roles in society currently, individuals may be required to adopt new work practices where they do not initially see value and where the required new practices are not well aligned with their identity (Reay et al., 2013). For example, researchers are encouraged to engage more frequently with science communication on social media. However, these practices may conflict with their professional identities, which are rooted in their roles as researchers.

An individual's professional identity is not stagnant but evolving, as is their perception of their professional identity and how they think about others in their profession. Elvey et al.'s (2013) study aimed to examine pharmacists' perceptions of their professional identity in terms of how they saw themselves and how they thought other people viewed their profession. Group and individual interviews were conducted with pharmacists employed in hospitals, the community and primary care settings in England with a total of 43 participants taking part. Several elements helped determine the professional identities of pharmacists, including personal traits (aptitudes and demeanour), attributes (knowledge and skills) and orientations (preferences) relating to pharmacists' work. This study identified the presence of nine different identities for pharmacists: the scientist, the medicines adviser, the clinical

practitioner, the social carer, the medicines maker, the medicines supplier, the manager, the business person and the unremarkable character. The scientist was the strongest professional identity to emerge, but there was an overlap with other professional identities (e.g. medicine makers). These results further emphasise the notion that identities are not stagnant or stable and may be viewed differently by different people. While this study identified different identities, these differences could be interpreted as different roles within the one identity, and this relatively high number of 'identities' may reflect some degree of role ambiguity or cognitive dissonance between professional role expectations and reality.

3.5 The 'Researcher' Identity

Within the literature, a researcher's identity has been referred to as a 'STEM identity', a 'science identity' or an identity specific to a discipline, such as an 'engineering identity'. A science identity has been broadly defined as the aspect of the self that relates to science (Carlone & Johnson, 2007). Academic identities are strongly associated with the membership of different communities, including discipline and research communities at international, national and local levels and university and department communities (e.g. Harris, 2005; Henkel, 2005). Generally speaking, the literature investigates researchers professional identities from two perspectives: the continuation of students into STEM fields (Carlone & Johnson, 2007; Hazari et al., 2013; Herrera et al., 2012; Perez et al., 2014) and the interaction between characteristics, such as gender, race and ethnicity and identification with the STEM or science fields (Carlone & Johnson, 2007; Kuchynka et al., 2018).

The previously discussed literature around professional identities and roles also resonates with researchers' professional identities. Professional identities and roles develop through a process of learning and socialisation within a professional setting which is also consistent with understandings of researchers' professional identities. For example, the previously discussed study conducted by Nadelson et al. (2017) found that students who

engaged in learning activities similar to the activities of STEM professionals had higher levels of professional identity development. Therefore, an individual's researcher identity develops alongside their learning about research. However, this researcher identity is not necessarily stable over the lifespan and can change or be renegotiated based on continual learning and engagement with the profession.

Furthermore, the function of cognitive flexibility, self-esteem and education in professional identity development is also seen within the development of researchers' professional identities. For example, Carlone and Johnson's (2007) model of science identity identifies three key factors—competence, performance and recognition—necessary for the development of a strong science identity. Competence refers to an individual's confidence in their ability to acquire and apply the knowledge necessary to understand scientific concepts. Performance involves an individual's confidence in their ability to demonstrate their scientific skills in a public setting. Lastly, recognition pertains to the individual's competence and performance being acknowledged by others, particularly by members of the scientific community. Together, these elements contribute to the formation of a robust science identity. Carlone and Johnson (2007) note that these factors are affected by gender, ethnicity and race.

Role conflict has also been observed in the researcher professional identity literature. For instance, Adiningrum et al. (2019) interviewed 14 part-time and 11 full-time academics in a private university in Indonesia to specifically understand the academic identities of part-time and full-time academics. Adiningrum et al. (2019) found that academics, irrespective of part-time or full-time employment, viewed themselves as possessing three distinct roles: teaching, research and community outreach. Participants also felt that their institutions expected them to take on administrative or managerial roles. More specifically, participants considered teaching and research as explicitly academic roles and the others as non-academic. Both part-time and full-time participants viewed teaching as the most important

and relevant role and was their preferred role which occupied most of their time. All participants saw teaching as their main reason for becoming academics, with research being the second reason. However, research may have been reported second because in Indonesia, most part-time staff only teach, and those who want to do research are only given limited support. Other roles, such as management and outreach, were not prominent for part-time academics or salient because these roles were closed to them. However, some did report that they preferred part-time employment because it allowed them to avoid these roles. Both groups felt that managerial responsibilities took the joy out of academic work, while most full-time academics viewed non-academic duties as intruding on the academic roles of teaching and research. This engagement in roles that conflict with more preferred role choices suggests a role conflict felt by these academics.

Many other studies have investigated different elements related to researchers' professional identities. For instance, Biscotti et al. (2009) examined the effects research funding has on the symbolic work of university scientists and, consequently, the development of their professional identities as independent scientists. In comparison, Archer (2008b) attempted to understand the formation of modern academic identities in relation to notions of authenticity and success. Additionally, more research surrounding professional or academic identities discusses the shifting nature of academic work and the effects of this on academic identities within higher education (Archer, 2008a; Clegg, 2008). Furthermore, literature suggests that individuals who identify strongly with the profession of science (science professional identity) are more likely to engage in decision-making that validates that identity or is in alignment with that identity (Eccles, 2009; Herrera et al., 2012; Perez et al., 2014), emphasising the reaffirming nature of researchers professional identities. However, what is missing within the literature is a clear understanding of the role researchers think they should have within science communication, how this is affected by or affects their identities as

researchers and the implications this has for researchers' engagement in science communication.

3.6 Conclusion

Developing a professional identity can be viewed as a social undertaking fostered and reinforced by socially engaging with others within the professional field. Developing a professional identity is not a case of attainment, where attainment is achieving the degree, and by default, you have attained the respective professional identity. Instead, professional identity involves the self-categorisation of oneself into that profession (Burford, 2012). For example, the transition from research undergraduate student to researcher does not simply involve qualifying but also refers to 'becoming' a researcher and internalising the researcher identity. Professional identities have a social and an individual dimension. The social dimension consists of the roles associated with the researcher's profession, while the individual dimension is the identification with this profession (Beam et al., 2009; Ibarra, 1999; Stevens et al., 2008). The process of developing a professional identity has been successful if someone meets the requirements of the social role. For example, individuals act as researchers, others recognise them as being researchers, they have identified themselves with the role, and they believe they are researchers. The literature on the development of professional identity consistently found that professional socialisation (Ashby et al., 2016; Hernandez et al., 2017; Hunter et al., 2007; Hunter & Cook, 2018; Price et al., 2021), previous knowledge or skills in the area (Nadelson et al., 2017; Park et al., 2018), cognitive flexibility (Adams et al., 2006), self-efficacy (Estrada et al., 2011; Hemmings, 2012) and gender all affected the development of professional identity in complex and interwoven ways.

Professional identities are shared with a group of other people who have (or are believed to have) some characteristics in common. Therefore, professional identities can also be understood as group-based identities (Ashmore et al., 2004). Consequently, group

members tend to be bound by similar principles of operation or behaviour. Professional identities signify collective norms, rules and values and provide symbols and social rituals specific to the group (Bayerl et al., 2018). Owing to the shared nature of the collective norms, rules and values, professional identities can transcend institutional contexts (Gomez-Mejia, 1984; Lammers & Garcia, 2009), meaning that researchers professional identities can be seen playing out across many different institutions and in many different situations. Identity and roles are not constructed independently of each other; an interplay between the two exists. Therefore, it is necessary also to understand how researchers' roles interact with their professional identities.

Although research on role conflict and role ambiguity is expanding, there remains a lack of sufficient investigation into the interplay between researchers' roles and their engagement in science communication and the implications this may have in terms of role conflict and role ambiguity. In particular, limited attention has been given to how researchers perceive their roles in the context of science communication. For example, it is unclear whether researchers believe they should participate in all forms of science communication or restrict their engagement to peer-reviewed journal articles. Additionally, the role of advocacy as a form of science communication raises questions about how it aligns with researchers' understanding of their professional roles and responsibilities and the consequential implications this may have in terms of role conflict and role ambiguity felt by the researchers. It is, therefore, essential to examine the intersection of professional identity and professional roles and their influence on researchers' engagement in all forms of science communication, including advocacy. The following chapter builds on the foundation of the previous chapters and situates the present study within the broader academic landscape, providing the necessary context for the current study and outlining the methodological framework employed within this thesis.

Chapter 4: Current Study and Methodology

4.1 Integrative Summary

Science communication is critical to societal progress; however, researchers employ diverse communication strategies, each with varying implications for the respective communication channels (Burns et al., 2003; Peters et al., 2008; Van Noorden, 2014; Weigold, 2001). Multiple contextual factors must be considered when examining the environment in which scientific communication occurs, including political, geopolitical, economic, and cultural dimensions (Akin & Scheufele, 2017). Historically, research in this field has primarily concentrated on optimising science communication strategies (Cooke et al., 2017; Gascoigne & Metcalfe, 2012, 2017; Treise & Weigold, 2002), with a smaller body of literature beginning to focus on the researchers themselves (Cologna et al., 2021; Dudo, 2015; Entradas et al., 2019; Lorenzoni et al., 2007; Murumga et al., 2024). However, this research has remained predominantly practical, focusing on the logistical and pragmatic aspects of participation rather than the psychological drivers that influence engagement. In contrast, this thesis shifts the focus to the researchers—who are the central agents in the communication process—by exploring the psychological mechanisms underlying their professional identities and roles as a means to better understand their engagement in science communication.

Given that science is inherently a social endeavour, and that the formation of a researcher's professional identity is shaped through socialisation processes, SIA offers a pertinent theoretical lens for exploring these identities. The literature suggests that researchers possess a distinct professional identity, within which science communication plays a pivotal role (Barnard, 2019; Park et al., 2018; Robnett et al., 2018; Tomlinson & Jackson, 2021). Thus, examining the professional identities of researchers provides a valuable framework for understanding how scientific knowledge is communicated. Professional

identities evolve as individuals advance in their careers. However, in terms of science communication, it remains unclear whether these changes pertain to shifts in the identity itself or to changes in the individual's conceptualisation of their professional role. In the context of this thesis, it is proposed that a researcher's professional identity, particularly within science communication, may remain a stable construct while perceptions of professional roles undergo transformation. This thesis contends that how an individual identifies as a professional will shape their understanding of their professional role and influence their behaviour within professional contexts. For instance, a researcher's professional identity may affect how they perceive their responsibilities in science communication and subsequently influence the modes of engagement they adopt, such as whether they advocate for specific scientific causes.

4.1.1 Primary Research Questions

The focus of this project was driven by the following primary research question:

- Why do some researchers choose to engage in advocacy-type communication while others do not?

To address the thesis's primary research question, the following study aims were developed:

- **Aim 1:** to understand how researchers perceive their professional roles and identity in relation to science communication and advocacy.
- **Aim 2:** to develop an understanding of how researchers interpret the interaction between science communication and advocacy.

The results and discussion sections of this thesis address these research aims and build towards addressing the primary research question. There are four results chapters (Chapter 5: Researcher Professional Identity Exploration, Chapter 6: Science Communication Responses, Chapter 7: Advocacy Communication Responses and Chapter 8: Factors Influencing Modes

of Engagement) and a general discussion (Chapter 9), which encompasses theoretical and practical implications, limitations and future directions for this research.

4.2 Considerations of Qualitative Research

Psychological research can only be meaningfully and appropriately interpreted when there is a clear and sufficient understanding of the philosophical principles and the theoretical assumptions of the individual researcher who is undertaking the research (Heberlein, 1988; Mascia et al., 2003; Newing et al., 2011). When a researcher fails to recognise and understand the principles and assumptions that they hold, the integrity and validity of their research design may be compromised (Moon & Blackman, 2014). Furthermore, if the principles and assumptions of the researcher are not clearly articulated it can limit, or worse distort, other people's interpretations of the research outcomes (Sievanen et al., 2012). Therefore, understanding the embedded assumptions of the researcher is a prerequisite when interpreting others' research (Moon & Blackman, 2014). This is particularly important in qualitative research as it requires the researcher to become one with the data and offer interpretations of the data based on their own understanding and experiences. Having a clear understanding of how data is being interpreted is imperative in assessing the results and outcomes of the research. Consequently, the theoretical and philosophical perspectives of the principal investigator for this research project are outlined below. This is followed by a description of the data collection and data analysis processes of this study.

4.3 Theoretical Perspective

This study took a qualitative approach because this project's aims were exploratory in nature rather than hypothesis testing (Smith & Osborn, 2015). An exploratory approach was used because there is limited literature examining the nuances of how Australian researchers' identities and roles interplay within the context of science communication and advocacy. Furthermore, there are limited appropriate quantitative scales for measuring identity and roles

in this context, with several scales being single-item measures. Measuring identity using a single-item scale is theoretically unsound and lacks adequate construct and content validity. Furthermore, internal consistency cannot be measured in single-item scales (Wanous & Reichers, 1996). Lastly, while science communication is clearly articulated in the literature, the understanding of advocacy by researchers is not well defined, and it is not clear how researchers understand advocacy and their role within advocacy and, consequently, science communication more broadly.

An exploratory qualitative approach, with interview data, allowed for a clearer interpretation of researchers' understanding of science communication and advocacy and allowed for the full exploration of these concepts without reducing to single-item measures. Furthermore, interviews provided the participants with the opportunity to describe and expand on their understandings of science communication and advocacy. Because there is no attempt to test a predetermined hypothesis, the aims were to explore, in a flexible and detailed manner, the area of interest through broadly framed research questions.

Several methodological approaches were considered for this qualitative project. Grounded theory allows for building theories from data; specifically, there is no predetermined theoretical framework, and the researcher's thoughts about the data guide the construction of the theoretical analysis (Glaser & Strauss, 1967). Grounded theory was discounted as the literature highlighted several theoretical perspectives that were appropriate for understanding professional identities. Discourse analysis was also considered owing to its focus on the role of language in the construction of social realities, specifically the structure and expression of language within social and cultural contexts (Potter & Wetherell, 1987). Discourse analysis, on the surface, parallels the focus of the current investigation in terms of social identity and the communication of scientific information. However, discourse analysis was discounted because of its focus on language as performative, its movement away from

the content of the text and focusing instead on what motivated the specific language used. A traditional phenomenological approach was also considered; however, its broad perspective and emphasis on the impact of a specific phenomenon for a group of people rather than the individual perspective led to concern regarding the ability to examine convergences and divergences within and across cases of participants (Pietkiewicz & Smith, 2014; Smith, 2011; Smith et al., 2009). Consequently, interpretive phenomenological analysis (IPA) was the most suitable methodological approach for this qualitative project.

IPA is an approach that is focused on the thorough exploration of lived experiences and personal meaning (Smith & Osborn, 2015). IPA provides a framework for the in-depth description and interpretation of the personal meanings and lived experiences of participants (Smith et al., 2009; Smith & Osborn, 2015). The process of IPA involves exploring the individual subjective perception of an experience rather than providing an objective statement of the experience itself (Smith & Osborn, 2015). IPA is a suitable approach for interpreting how individuals understand and make sense of their personal world and how they perceive the specific situations they are facing (Smith & Osborn, 2015). IPA, therefore, was deemed the most appropriate approach because it provides the ability to assess the aims of the project. Considering IPA is particularly valuable in research questions concerned with complexity, process or novelty, it is especially well suited to the research questions proposed in this project. Additionally, IPA provided a good fit with understanding the mechanisms of identity and role by gaining participants' subjective descriptions and evaluations of their and others' identities and roles.

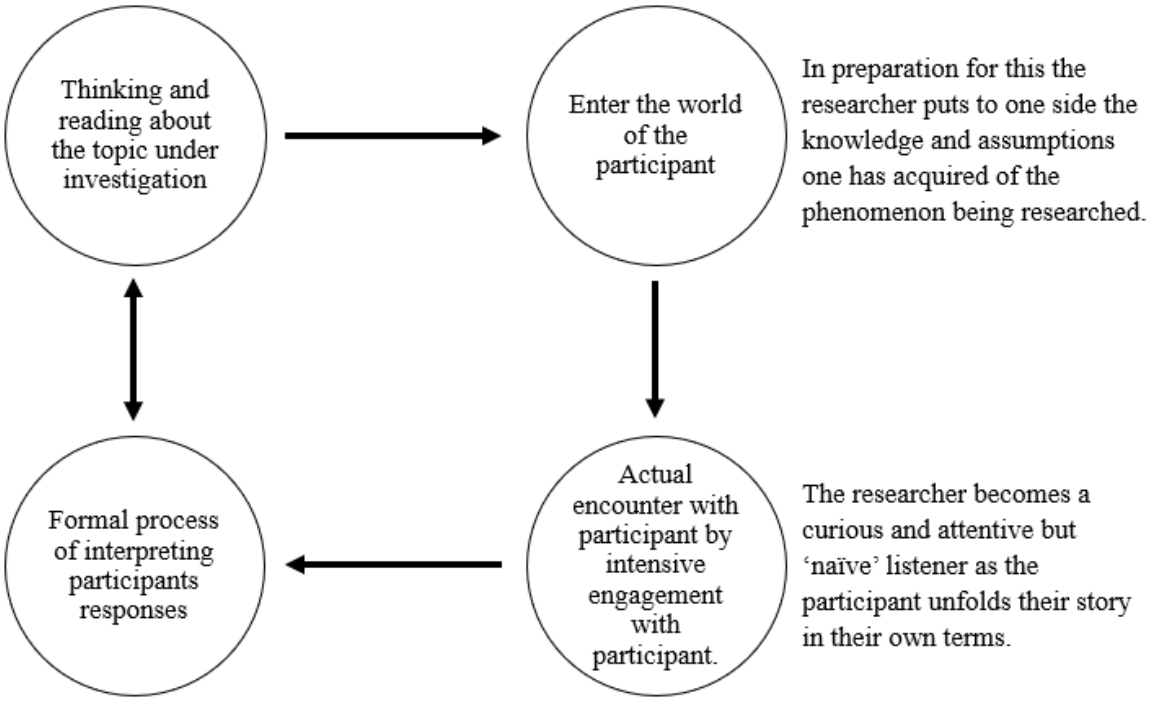
IPA was established as a psychological experiential research methodology rooted in phenomenological philosophy, focusing on the detailed examination of participants' lived experiences (Smith & Osborn, 2015). Furthermore, IPA highlights the active role that the researcher plays in this process. The researcher must engage in a process of interpretative

activity where they attempt to develop an insider perspective of the participants' worldview, which is complicated by the fact that this cannot be done directly or completely and is influenced by the researcher's own conceptions (Smith & Osborn, 2015). This is in line with the hermeneutic development of phenomenology; indeed, IPA is influenced by hermeneutics in that interpretations of individual experiences are a central requirement of IPA. Hermeneutics refer to the practice of interpretation and describes a methodology for interpreting texts, concepts and objects, and a theory for understanding these interpretations (Ashworth, 2015). In IPA, not only are the participants trying to make sense of their world but the researcher is also trying to make sense of the participant trying to make sense of their world (Smith & Osborn, 2015). Therefore, the researcher cannot simply describe the participant's individual experience. They must also interpret and make sense of the individual's interpretation of their own lived experience.

The process of an IPA study can be viewed as an interpretive cycle (Figure 4.1). During the formal interpretation process, the researcher tries to make sense of what the participant has experienced, ensuring that this analysis is always grounded in the actual words of the participant (Smith & Osborn, 2015). Importantly, this analysis will also be informed by the researcher's own personal interests and expertise, which are brought to the reading of the text (Smith & Osborn, 2015).

Figure 2.1

Interpretive Phenomenological Analysis Interpretative Cycle



It is important to acknowledge that it is impossible to truly know what a participant knows (Smith & Osborn, 2015). All a researcher has is an account of an individual's experience, which is relayed to them through the interview process. This requires the researcher to offer interpretations of participants' experiences. Consequently, it is inevitable that a researcher's own perceptions will influence this interpretation of the participant's experience (Smith & Osborn, 2015). The philosophical perspective and positionality of the principal investigator are discussed below to aid in understanding the principal investigator's personal perceptions.

4.4 Philosophical Perspective

Before embarking on qualitative research, it is important to understand the ontological and epistemological perspectives that drive your research and influence how you view the world. Stemming from this ontological and epistemological perspectives are philosophical

perspectives. These philosophical perspectives are a system of generalised views of the world, which form beliefs that guide action (Guba & Lincoln, 1994; Spirkin, 1983). Therefore, how a researcher chooses their methods demonstrates a commitment to a version of the world and how the researcher can learn about that world (Moon & Blackman, 2014). The principal investigator's positionality is outlined below, describing the ontological and epistemological perspectives that form the foundation on which this project is built and will be shaped.

The principal investigator was born and raised in Townsville, a regional city in North Queensland. The principal investigator was raised in a household with her mother and father, both marine biologists, and she has one younger brother. Her parents' careers as marine biologists resulted in the principal investigator being reared in a household with a strong focus on the scientific method and empirical understandings of the world. This has shaped the principal investigator's understanding of the world and her understanding of science and has shaped her thoughts surrounding the importance of science and research to society. This has also meant that the principal investigator developed a realism ontological perspective and an objectivist epistemological position throughout her life.

Throughout her childhood and adolescence, the principal investigator's parents instilled the value and importance of education and its importance as the foundation for growth and identity. The importance placed on education and the value of knowledge to society has helped shape the principal investigator's educational journey through an appreciation for education, which is a driving force in the continuation of learning through this PhD.

The principal investigator completed a Bachelor of Psychology at James Cook University. Throughout this degree, the principal investigator began to change her perspectives on research, what exists that we can acquire knowledge about (ontology) and

how we can create knowledge (epistemology). She began to understand the impacts of culture and society on individuals' mental construction of reality and began to understand that there may be instances where reality is constructed within the human mind and that reality is relative to each individual who experiences it at a given time and place. Owing to her upbringing and subsequent learnings through higher education, the principal investigator approaches the world with a mixed ontological perspective of structural realism and bounded relativism.

To explain this using Proctor's (1998) example, where Proctor asked whether wilderness can be universally experienced, defined and measured (realism) or whether groups of individuals experience, define and measure wilderness differently (relativism). While the principal investigator believes that wilderness is something that can be universally understood, measured and experienced, exactly how it is understood, measured and experienced changes depending on the group of people with whom you discuss it. Furthermore, the principal investigator holds a plurality of epistemologies (constructionism and subjectivism), which she must be cognisant of throughout the research process, especially when interpreting and making sense of the participant's interpretation of their own lived experience.

This study is further underpinned by an etic ontological perspective of being receptive to the notion that objectivity relies on detaching oneself from biases and prejudices (Holmes, 2020). It is important that the principal investigator acknowledges and understands her own biases affecting the research and communities involved, given that she is an 'outsider' to the disciplines the participants belong to (STEM and public health disciplines) and the academic culture more broadly. These biases may be informed by society's expectations of researchers, the roles and responsibilities of researchers enforced by exposure to the media and a Western education system, and personal upbringing. As much as the principal investigator will

endeavour to detach herself from such biases, it is recognised that attempting to achieve 'true' objectivity in qualitative research is futile, as no objective criterion exists to verify that understandings reflect objective realities (Sparkes & Smith, 2013).

4.5 Data Collection

Within an interpretative phenomenological analysis framework, particular attention must be given to the data collection methods, including the recruitment of participants and the sampling procedures used. The formulation and delivery of interview questions also require careful consideration. Additionally, understanding the contextual and geopolitical factors that may uniquely influence participants' experiences is essential to interpret the data accurately.

4.5.1 Contextual and Geopolitical Considerations

Data collection was conducted over three months (October–December 2020) during a worldwide pandemic (COVID-19), when the value of science and science communication was paramount in society's eyes. Specifically, this was a period in which the value of science and science communication was extremely high (Bromme et al., 2022; Luna et al., 2021). However, because the value was high, it also meant that science became a target for opposition and conspiracy (Agley, 2020; Goldstein & Wiedemann, 2022). Consequently, trust in science both increased and decreased for different groups of people throughout this time (Agley, 2020). Moreover, for some people, this would have been an increasingly stressful time to communicate science. Consequently, participant's opinions and attitudes towards the communication of their research may have been influenced by this global conversation.

Data collection also occurred during the 2020 United States Presidential Election in which Donald Trump was running for re-election against Joe Biden. During this time, there was a significant amount of media coverage of the election (even in Australia), with many

statements by Donald Trump being shown in the media. Donald Trump was the public icon for spreading misinformation and disinformation, which spiralled during this time (Evanega et al., 2020). Because of this, scientists were simultaneously more trusted and distrusted. The dichotomy of trust experienced by researchers may have led to a more stressful time for them —trying to weigh the costs and benefits of engaging in communication. These circumstances may also have pressured researchers to communicate when they may not have ordinarily done so. Consequently, these elections greatly influenced the global narrative relating to truth and trust, the value of science and the importance of scientific knowledge (Hamilton & Safford, 2021; Watson & Hanks, 2023). Therefore, the participants' opinions and attitudes may have also been influenced by this global conversation.

4.5.2 Sampling Procedure

The sampling procedure involves three considerations: (1) sampling method, (2) sample size and (3) sample demographics.

4.5.2.1 Sampling Method. IPA is idiographic in nature (Smith et al., 1995) in that it is interested in a comprehensive examination of certain individuals and in understanding the experience of specific individuals in specific situations (Smith & Osborn, 2015). Furthermore, researchers using an IPA framework try to obtain a fairly homogeneous sample and, therefore, attempt to find, through purposive sampling, closely defined groups for whom the research question will be important and relevant (Smith & Osborn, 2015). Purposive sampling techniques are used when the research requires deliberately and specifically chosen participants. Purposive sampling is appropriate within the IPA framework because there is a specific attempt to understand the individual experiences of participants rather than the experiences of all individuals in the selected population (Smith & Osborn, 2015). Accordingly, purposive sampling was used within this project and involved recruiting

researchers from specific disciplines. This study chose to recruit specific participants per the inclusion and exclusion criteria outlined below (Table 4.1).

Table 4.1

Inclusion and Exclusion Criteria

Inclusion	Inclusion Criteria Justification	Exclusion	Exclusion Criteria Justification
Any gender.	The perspectives of all genders were sought for this study.	1. Participants from outside of Australia.	To attempt to control the influence of outside contextual influences on the experiences and perspectives of researchers.
They had obtained a PhD (no time frame associated with this).	To ensure that all participants had developed their professional identity.	Individuals who do not speak English.	The principal investigator only speaks English; therefore, individuals who did not speak English were excluded to aid with the ease of communication and interpretation.
They had a publication in a peer-reviewed journal within the last five years.	This was to ensure that participants were still actively engaged in the research process.	Conflict of interest: actual or perceived, family or professional.	The principal investigator's parents both work at the university, as do the principal investigator's supervisors; therefore, participants were screened for actual or perceived family or professional conflicts of interest.
They worked in public health, STEM or social sciences.	To narrow the scope and have a case study of a few disciplines of researchers only.	People that did not response after the first round of communication.	Participants were only contacted once about participation, and if they did not respond to the initial email, they were excluded from the study.
They were currently employed and lived in Australia.	This was to ensure consistency in the societal construct.		
They had postgraduate training at a Western university.	This was to ensure consistency in understanding and training of the scientific method.		

While the purpose of IPA is not to obtain a sample that you can draw generalisations from; it was still hoped that a sample of participants would be recruited that was not geographically isolated to one specific area of Australia. This is because a substantial number of contextual factors affect researchers' beliefs around advocacy in science communication. Therefore, obtaining a wider range of perspectives would be useful to understand how these factors influence these beliefs. Furthermore, a sample of participants from one discipline at one institution would not allow an exploration of the nuances associated with the topic. Initial recruitment occurred at the host university (James Cook University) with subsequent snowballing resulting in an adequate sample size for the project.

4.5.2.2 Sampling Size. A distinguishing feature of IPA is its commitment to a detailed interpretive account of the data, with importance placed on interpretation and exploration of individual experiences (Smith & Osborn, 2015). This detailed case-by-case analysis of individual transcripts is time-consuming, and the main aim is to say something in detail about the perceptions and understandings of a particular group rather than make general claims (Smith & Osborn, 2015). Consequently, there are no strict guidelines regarding sample sizes within IPA, and they can vary from one (Eatough & Smith, 2006) to 15 or more (Smith & Osborn, 2015).

While there is no right answer regarding sample size, several factors need to be considered as they affect sample size. These factors include the degree of commitment to the case study level of analysis and reporting, the richness of the individual cases, and the constraints the researcher is operating under (such as time constraints) (Smith & Osborn, 2015). Because good IPA interviews generate a large quantity of detailed data, it is necessary to juggle the previously described constraints against the sample sizing to allow for sufficient in-depth engagement with each individual case while also allowing a detailed examination of similarity and differences, convergence and divergent (Smith & Osborn, 2015). It is

necessary to consider all these factors carefully to produce a sufficiently penetrating analysis. Consequently, all participants who expressed interest in participating in the project were interviewed.

4.5.2.3 Sample Demographics.

4.5.2.3.1 James Cook University. James Cook University was chosen as one of the target universities for several reasons: It was the home university of the research team, it was a regional university, and it had a successful science discipline with several highly successful researchers and influential science communicators. A potential pool of participants was selected by accessing the research portfolio college listing (College of Public Health, Medical and Vet Sciences, College of Science and Engineering, and College of Arts and Society and Education) and downloading a list of all academics and contact email addresses. From these lists, the principal investigator and supervisors went through and selected individuals from each of the colleges (n = 46 College of Science and Engineering, n = 13 College of Public Health, Medical and Vet Sciences, and n = 5 College of Arts and Society and Education). The principal investigator and supervisors needed to filter the full list of academic staff to ensure the removal of participants who had existing relationships with and/or conflicts of interest with any of the research team.

The differences in target sample size and actual sample size (reported below) from each of the target groups reflect the different population sizes of each group. For example, the College of Science and Engineering had the most staff for the target group and, therefore, had the largest sample size within the project. In contrast, the College of Arts and Society and Education had the smallest number of staff and the smallest sample size.

Recruitment of participants began in September of 2020, with interviews commencing in mid-October and continuing through to mid-December. Initially, an email invitation (Appendix A) was sent out to the selected participants with a detailed information sheet

attached (Appendix B). The participants were also asked to share the study information sheet with other potential participants (snowball recruitment). A total of 25 participants (10 females and 15 males) responded and were interviewed from James Cook University. The average age of participants was 50.96 years (*SD* = 10.2, Range = 35–74). Participant career stages ranged from mid-career (5–15 years post-PhD; *n* = 11) and late-career researchers (15 + years post-PhD; *n* = 14).

4.5.2.3.2 Snowball Recruitment. Snowball recruitment was used in this study, where participants directly contacted were asked to share the study information sheet with other potential participants. These snowball participants emailed the principal investigator, stating their interest in participating. The principal investigator assessed each participant against the inclusion/exclusion criteria before organising a participation time. Eight participants (five females and three males) responded through snowball recruitment and were interviewed. The average age of participants was 46.87 (*SD* = 7.7, Range = 35–57). Participant career stages ranged from early-career (5 years post-PhD; *n* = 1), mid-career (5–15 years post-PhD; *n* = 3) and late-career researchers (15 + post-PhD; *n* = 4). These participants came from the following institutions: universities (*n* = 3), non-government organisations (*n* = 3), State Government (*n* = 1) and Federal Government (*n* = 1).

4.5.2.3.3 Total Participant Sample. A total of 33 researchers (*M* age = 49.9, *SD* = 9.6) agreed to participate in the study (female *n* = 15, male *n* = 18). Participant career stages ranged from early-career (5 years post-PhD; *n* = 1), mid-career (5–15 years post-PhD; *n* = 16) and late-career researchers (15 + post-PhD; *n* = 15). At the time of data collection, 28 participants were employed in universities, one in State Government, one in Federal Government and three in non-government organisations. Additional demographic

information can be found in Table 4.2. Participants were located along the eastern seaboard of Australia (Figure 4.2).

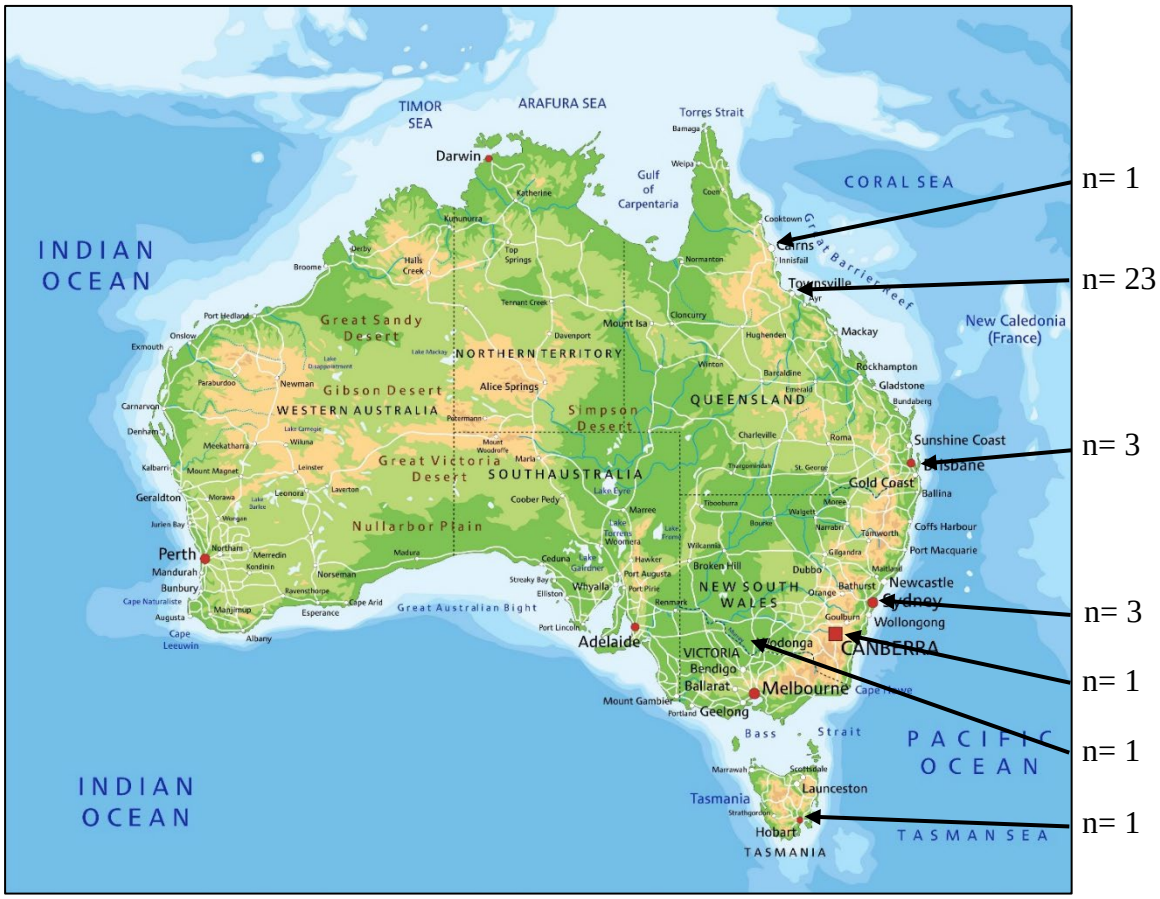
Table 4.2

Demographic Details of Participants

Position	Country Where PhD was Attained	Discipline
Distinguished profession (*n* = 2)	Australia (*n* = 27)	STEM (*n* = 20)
Professor (*n* = 8)	United States of America (*n* = 5)	Public health (*n* = 7)
Associate profession (*n* = 7)	New Zealand (*n* = 1)	Social science (*n* = 6)
Senior lecturer (*n* = 5)		
Research fellow (*n* = 2)		
Research officer (*n* = 2)		
Adjunct professor (*n* = 2)		
Lecturer (*n* = 1)		
Director (*n* = 1)		
Research and policy coordinator (*n* = 1)		
Campaigner (*n* = 1)		
Senior research scientist (*n* = 1)		

Figure 4.2

Image of Australia Depicting Sample Sizes from Each Geographic Location.



Note. Retrieved from Shutterstock (https://www.shutterstock.com/image-vector/high-detailed-australia-physical-map-labeling-228959416).

4.5.3 Constructing and Conducting the Interview

4.5.3.1 Semi-Structured Interview Development. A semi-structured interview design was employed in this study. This type of interview provides the researcher and the participant with the opportunity to engage in a dialogue, which allows for flexibility to explore ideas during the interview through the modification of initial questions considering participants' original responses (Padgett, 2017; Patton, 2002; Smith & Osborn, 2015), develop rapport (Smith & Osborn, 2015) and enable the collection of richer data (Smith et al., 2009; Smith & Osborn, 2015). A semi-structured interview design is a flexible data collection

instrument and is appropriate for use within the IPA framework because it allows participants to engage in a full and flexible exploration of their experiences with the researcher (Smith & Osborn, 2015). This aligns with the types of analysis necessary within the IPA framework. That is, a detailed analysis of how participants perceive and make sense of a particular issue (Smith & Osborn, 2015).

The interview consisted of six demographic questions (Table 4.3) and 20 open-ended questions with associated prompt questions (Table 4.4). Open-ended questions were developed to advance understanding of each participant's opinions relating to science communication and advocacy. Participants were asked at the end of the interview if there was any additional information they wanted to add that was not covered by the interview. A prior theoretical framework informed question development, which helped shape the general direction and flow of the interviews. This theoretical framework was based on an extensive literature review, which suggested that the divergence in researchers' active engagement in science communication can be understood through a social identity approach. Therefore, SIA was used to shape the interview questions.

Table 4.3

Demographic Questions

Question
How old are you?
What year did you get your PhD?
Where did you get your PhD?
What is your field of research/ what is your specialty?
What discipline do you work in?
What institutions have you worked in?

Table 4.4

Interview Schedule

Focus	Questions	Prompt Questions	Theoretical Underpinning
Researcher identity	What is the importance of research to society?		
	Tell me about your life and what lead you to become a researcher?	What made you want to get into science and/or research?	Social identification
	In your eyes then, when did you start being a researcher?		Social identification
	Thinking about now, could you tell me what you consider your professional role to be?		Social identification/ self-categorisation
	What is your current motivation to be a researcher?		Self-categorisation
	What makes someone a researcher or a scientist?		Social comparison
	Thinking about those characteristics you just described to me do you think these ring true for all researchers?	Why/Why not? Even those researchers from different disciplines to yourself?	Social comparison
Science communication	Should researchers have a role as communicators of scientific information?	Why/why not?	Social comparison

Focus	Questions	Prompt Questions	Theoretical Underpinning
	Should all researchers be science communicators?	Or only researchers from specific disciplines?	Social comparison
	What avenues should researchers be using to communicate information?	Is social media acceptable or only journal articles or through journalists etc?	Social identification
	So, what then is the role for researchers to be communicators of scientific information?		Social/self-categorisation
	What is the responsibility for researchers to be communicators of scientific information?		Social/self-categorisation
	Do you actively engage in any form of science communication?	Why/why not?	Self-categorisation
	What communication would you be unwilling to engage in?	Is there a specific type of communication such as social media?	Social identification
	How do you decide the extent to which you publicly comment about science?		Social Identification

Focus	Questions	Prompt Questions	Theoretical Underpinning
Advocacy	What do you think about advocacy by scientists or researchers?		Social comparison
	In your opinion, do you think that scientists or researchers should be engaging in advocacy?	Why/why not?	Social comparison
	How do you think researchers should go about it?		Social comparison
	Where is the line between what is acceptable and what is not acceptable when it comes to advocacy?		Social comparison
	What are/is the cost of engaging in advocacy?	Are there reputation or professional cost?	Social comparison

The interview schedule was developed by following the suggested sequences for producing an interview schedule outlined in Smith and Osborn (2015): 1. Outline the broad range of topics to be covered in the interview; 2. Place the topics in appropriate sequences determined by the logical order to address these topics and the sensitivity of the topic (more sensitive topics should be left until later in the interview when rapport has been established); 3. Outline appropriate questions related to each topic area; and 4. Identify possible probes and prompts. All attempts were made to ensure the interview questions were not value-laden, leading or contained jargon.

Furthermore, the questions were designed to encourage the participant to speak openly about the topic with as little prompting from the researcher as possible (Smith & Osborn, 2015). The technique of funnelling, which can help reduce bias in data, was also used in designing the interview schedule. This technique is used when you are interested in eliciting a respondent's general views about an issue (e.g. importance of science communication) as well as more specific views (e.g. their experience with communicating or advocating science; Smith & Osborn, 2015). The interview schedule was developed by the principal investigator and was reviewed by the supervisors, Dr Anne Swinbourne and Dr Maxine Newlands, who both have prior experience with qualitative semi-structured interview design. Both supervisors provided input into the topics being covered and the wording of the questions.

4.5.3.2 Interview Procedure. The Human Research Ethics Committee at James Cook University granted ethical approval for this study (H8009). All participants were invited to participate via email from the lead investigator (Appendix A) with the project information sheet attached (Appendix B). Once participants acknowledged that they wanted to participate in the study, the principal investigator emailed them to find a suitable time and format (via Zoom or face-to-face) for participation. Before all interviews, participants were provided

with information about their rights and the purpose of the study and were subsequently invited to sign a consent form. For those participating via Zoom and over the phone, the principal investigator emailed the participants the information sheet again for their records and asked them to read and sign a consent form (Appendix C) and email it back to the investigator before the interview. For those participating face-to-face the consent form and information sheet were taken to the interview and read and signed prior to the start of the interview. Before the interview commenced, the principal investigator answered any of the participant's questions relating to the information sheet or consent. All participants were asked whether they consented to the interview being recorded prior to the commencement of the interview. The principal investigator conducted the Zoom and telephone interviews in the primary adviser's private laboratory space. Each interview was audio-recorded using an Olympus Digital Voice Recorder DM-720. The Zoom meetings were also recorded using the Zoom record function.

There were 33 interviews conducted; most interviews were conducted via Zoom (n = 21), with the remaining conducted face-to-face at a setting the interviewee selected, their office on campus within COVID-19 regulations (n = 11) and over the phone (n = 1). All interviews were conducted with one participant and one interviewer (principal investigator), with the principal investigator facilitating all interviews. General demographic data were obtained from each participant at the beginning of each interview (Table 4.2). Each interview followed the semi-structured interview schedule (Table 4.3). The average duration of an interview was approximately 54 minutes, with a total accumulated time of 1,788 minutes and 12 seconds (29 hours, 48 minutes and 11 seconds). Upon completion of the interview, participants were thanked for their time and given the opportunity to ask any questions they might have about the study and provide any relevant information that may have been missed during the interview.

The principal investigator transferred interview recordings to a computer file and manually transcribed them verbatim into a Word document. A random selection of the transcribed interviews was checked for transcription reliability by one of the principal investigator's colleagues. Additionally, hard-to-understand sections of the recorded interviews were checked by the same colleague. The Zoom recording and transcription software were used for interviews conducted on Zoom. These transcripts were downloaded from the online Zoom platform as a.txt file, copied into a Microsoft Word document and cleaned and checked for accuracy by the principal investigator. Transcription took an average of four hours of transcription for every one hour of interview audio. Transcribing took an average of 216 minutes per interview (3 hours and 36 minutes), and an accumulated time of 7,152 minutes (119 hours and 12 minutes) was spent transcribing.

4.6 Data Analysis

A deductive reflexive thematic analysis within the IPA framework was adopted when examining the transcribed interviews. More specifically, IPA was used to guide the design of the semi-structured interview schedule, ensuring that questions were grounded in the lived experience of participants. Reflexive Thematic Analysis, in turn, was used to guide the analysis of the data, allowing for a flexible and iterative approach to identifying and interpreting patterns of meaning. This process was used to identify, analyse and report on patterns within the data. Below is an overview of the characteristics of the research team and their contribution to the research project. Following this is an outline of the thematic analysis and a detailed outline of how each step of the thematic analysis was implemented in this project. The software program NVivo 20 (release 1.7) was used to assist with analysing the interview data.

4.6.1 Researcher and Research Team

IPA emphasises that research is a dynamic process and the researcher takes an active role in this process (Smith & Osborn, 2015). Owing to this active role, understanding an individual's experiences and perceptions is necessary for data analysis.

4.6.1.1 Researcher. At the time of data collection, the principal investigator was a 28-year-old female PhD student in psychology at James Cook University. Through the principal investigator's undergraduate degree, she developed her skills in research design and analysis, interviewing techniques and rapport building. While the principal investigator held research assistant positions requiring research design, recruitment and data analysis, this project was the researcher's first experience with qualitative research and analysis of this size. The principal investigator was responsible for the entirety of this project, including recruiting participants, designing and conducting the interviews, transcribing interviews for analysis and analysing interview transcripts.

The principal investigator was younger than her participants; however, neither age nor gender was likely to have affected the interviews as these factors did not appear to affect the flow of the interviews nor the participants' willingness to discuss any of the topics. At times, participants' comments required elaboration to facilitate the principal investigator's understanding; however, participant-researcher relatability did not appear to present a significant issue, given that the interview conversations flowed freely. Any general misunderstanding and interpretation issues were considered in meetings with the supervisors.

4.6.1.2 Research Team

The research team members were from disciplines outside the main recruitment groups, with Dr Anne Swinbourne (primary supervisor) from the psychology department and Dr Maxine Newlands (secondary supervisor) from political sciences. Both supervisors were academically active. Dr Anne Swinbourne had a Bachelor of Science degree, while Dr

Maxine Newlands works extensively with the environmental social sciences. Owing to the principal investigator's upbringing within a biophysical science-dominated landscape and the knowledge, insight and understandings brought forward by the supervisors, it is believed that an accurate understanding of the nuances of the responses can be interpreted. However, the principal investigator acknowledges that there is no objective way of measuring this.

Partway through data analysis, the principal investigator's primary supervisor (Dr Anne Swinbourne) passed away unexpectedly. Consequently, a new primary supervisor (Dr Connar McShane) moved on to the project. Dr Connar McShane has a Bachelor of Psychology (Honours) and PhD in psychology degrees and extensive experience with qualitative research, particularly with thematic analysis techniques. Highlighted below are the stages of thematic analysis to which each supervisor contributed.

4.6.2 Thematic Analysis

The principal investigator led the data analysis. A deductive, reflexive thematic analysis approach was adopted within the IPA framework. Thematic analysis is a flexible approach to data analysis that can be used within a wide variety of approaches to qualitative research (Smith & Osborn, 2015). Consequently, it is a suitable approach within the IPA framework (Clarke et al., 2015). Thematic analysis is an approach that allows for identifying, analysing and reporting patterns within a qualitative data set (Braun & Clarke, 2006; Clarke et al., 2015). Braun and Clarke (2006) outline a recursive six-step process for conducting thematic analysis (Figure 4.3). Each of the six steps is explained in Table 4.5, and how they apply to the current research project is discussed below.

Figure 4.3

Recursive Thematic Analysis Process

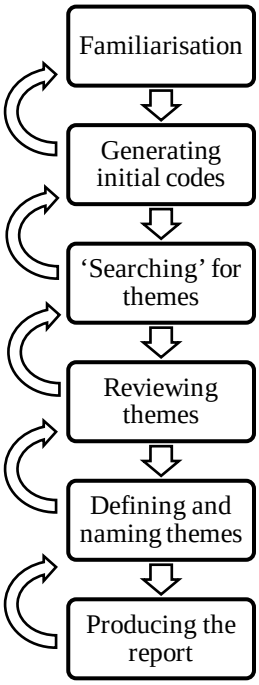


Table 4.5

Phases to Conduct Thematic Analysis

Phases	Description
Data familiarisation	Transcribing the interviews, reading and re-reading the transcripts, listening to the audio recording and documenting initial analytic observations.
Generating initial codes	Systematically identifying and labelling relevant features of the interview data relative to the research question.
Searching for themes	Clustering together similar codes under an umbrella term to create a possible map of the key patterns in the data. Beginning to diagram themes to explore connections can be started at this stage.
Reviewing themes	Comparing the suggested themes against the original interviews to determine when they exhibit a good 'fit'. Further assessing that each suggested theme is clear and distinctly unique. At this stage, engaging in 'critical friends' meetings is of paramount importance.
Defining and naming themes	Explaining the overall meaning of each theme and selecting a theme name ensures the conceptual clarity of each theme and that each theme represents one main idea.
Producing the report	Describing the process of coding and theme development. Detailed analytical narrative with explanatory text descriptions and examples. Themes are used to create the organisation framework for the analysis, but analytical conclusions are drawn across all themes.

4.6.2.1 Data Familiarisation. Familiarisation involves spending quality time with the data (Clarke et al., 2015). The principal investigator conducted the interviews, which aided in initial familiarisation with the dataset. Furthermore, after each interview, the principal

investigator wrote notes about the interview. The principal investigator transcribed verbatim all the interviews. Through this process of transcribing the interviews, the principal investigator became familiar with the interview recordings and the transcripts. These transcripts contained pauses and other verbal information to retain the context and integrity of the dataset. Throughout the analysis process, the principal investigator re-read the interviews with the audio playing to aid in data familiarisation.

4.6.2.2 Generating Initial Codes. Transcripts were created as Word documents, and Word's comment function was used to record the principal investigator's thoughts on the interviews while transcribing. These comments were then transcribed into the memo function of NVivo when the interviews were moved into the NVivo software. In the first re-reading and re-listening of the interviews the principal investigator recorded possible meanings of the participant responses. The recording of these notes at each stage aided in the development of initial codes and assisted with data familiarisation as described in the previous step.

Initial codes were generated by the principal investigator from semantically similar participant interview responses throughout the data set. At this stage, one-word codes were avoided because their meaning may not be clearly understood when removed from the context of the data (Clarke et al., 2015). Codes that are single-words and vague make the next step of identifying connections between the different codes difficult. Therefore, short phrase codes were used that captured the key aspects of that piece of data, sometimes using the participant's actual words. Data excerpts were coded more than once if they applied to multiple codes. No limit was placed on the number of codes or the amount of data included in a code.

4.6.2.3 Searching for Themes. The principal investigator developed a tentative framework of broader themes by clustering related codes that were linked to the research questions. Although semantic similarities of the data originally guided the thematic

framework, the latent meanings (or content) of responses were also explored and included where relevant. Latent content analysis is interpretive in nature and is used to understand and explain the meaning behind what the participant has said (Clarke et al., 2015). Latent content analysis is appropriate within an IPA framework because of the interpretive nature of IPA, and it is the researcher's role to interpret the participant's interpretation of their own experiences. Positive and negative opinions were also coded within the data. While the researcher drew on psychological theories such as the SIA, there was no attempt to limit the explanation of themes emerging from participant responses to this theory. Rather, a deductive approach was adopted in which the SIA provided an overarching theoretical lens to inform the development of the interview questions and to guide the initial interpretation of the data. The theory helped shape the focus of the analysis and sensitised the researcher to particular identity-related constructs, such as group norms, identity salience, and depersonalisation. However, the analysis remained responsive to participants' voices, and when responses deviated from theoretical expectations or introduced new ideas, these were not dismissed but explored in depth. The aim was to interpret participant experiences through a theoretically informed lens while remaining open to insights that extended beyond the scope of the original framework.

4.6.2.4 Reviewing Themes. As a way of better representing the data, higher-order categories and sub-themes were developed. The themes were further refined during a series of 'critical friends' meetings. Critical friends is a process of critical dialogue between the principal investigator and the supervisors to provide critical feedback on the data interpretation and analysis (Sparkes & Smith, 2013). Dr Maxine Newlands and Dr Connar McShane engaged in 'critical friends' meetings with the principal investigator. Reflexive in nature, these meetings provided an opportunity for the themes to be critically analysed, re-named, re-ordered and, in some cases, abandoned to best capture the data content.

Importantly, this process did not involve consensus coding. Rather than attempting to align or agree on codes, the principal investigator used these discussions to explain and critically reflect on the interplay between overarching themes and subthemes, the theoretical connections emerging from the data, and the broader contextual landscape within which participants' experiences were situated. This allowed the principal investigator to address the research questions. It also allowed for the exploration of researcher's roles and identities and their attitudes to different forms of science communication, including advocacy.

4.6.2.5 Defining and Naming Themes. At this point, theme definitions were written. This followed the format described by Clarke et al. (2015) in which short descriptions of each theme's essence, scope, coverage and boundaries were written. This step was key in providing the organisation and flow of analysis within each overarching theme, providing an effective roadmap for the next stage (writing the report). Finalising the name of each theme was done by capturing the essence of each theme and ensuring that the name chosen was a true and accurate representation of the data.

4.6.2.6 Writing the Report. Within this study, this step occurred during the development of the subsequent result chapters. Importantly, engaging in the writing process allowed for further reflection of the data, the subsequent analysis of the data, and, finally, to consider the appropriateness of the analysis when considering the data (Braun & Clarke, 2006). This written report was also compared with the original interviews to ensure that each participant's relevant perceptions were clearly and appropriately captured. Consistent with the philosophical assumptions underpinning this research, the quantitative occurrence of coded segments was not reported (Sparkes & Smith, 2013). The purpose of qualitative analysis is to explore the depth and complexity of participants' experiences rather than to quantify responses (Smith & Osborn, 2015). Reporting numbers or percentages in this context would impose a quantitative weighting on qualitative data, suggesting that the prevalence of a theme

determines its significance. However, in qualitative research, even insights expressed by a small number of participants can be critically important, offering unique perspectives that contribute to a richer understanding of the phenomenon under investigation (Smith & Osborn, 2015). Thus, themes were identified and interpreted based on their relevance to the research question rather than their frequency within the dataset.

4.7 Conclusion

Chapters 5–8 present the reflexive thematic analysis results from this research. Chapter 5 presents participants' responses relating to their identity as researchers. Chapters 6 and 7 present participants' perceptions and understandings of science communication and advocacy, respectively. Last, Chapter 8 contextualises participants' responses and discusses factors influencing modes of engagement.

Chapter 5: Researcher Professional Identity Exploration

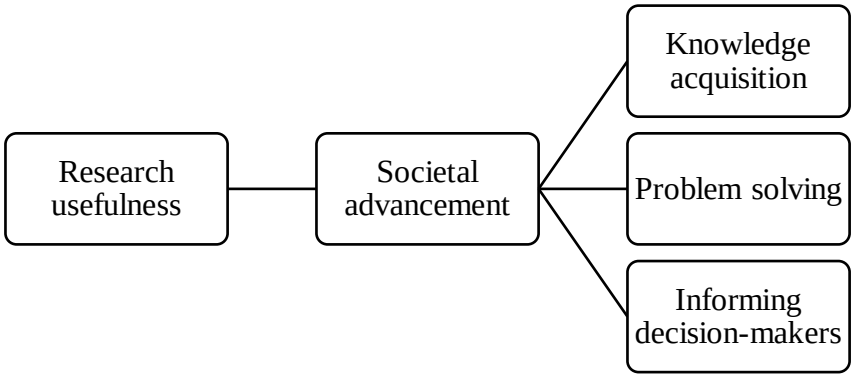
As discussed in the preceding chapters, professional identity explored through the lens of SIA has been used to address the aim of this thesis. Accordingly, it was necessary to ask participants questions to examine their professional identities as researchers—with questions designed to understand how participants viewed their professional identities and how they viewed a 'researcher' identity more broadly. The purpose of this chapter is to outline the key characteristics of professional identity in the sciences, and the chapter begins with participants describing the usefulness of research to society, followed by describing in their own words what they considered to be the characteristics of a researcher. The chapter then discusses professional identity formation by exploring identity development, embodiment of identity and role identification as described by participants. This chapter concludes by exploring the enduring stability of researchers' identities before providing a general summary of the chapter.

5.1 Research Usefulness

Participants discussed the usefulness of research to society, providing a broad and overarching contextualisation of the important role that research occupies within society. Importantly, this provides insights into the societal value that participants attribute to their profession while also serving to contextualise their conceptualisations of the researcher role more generally. Overall, the findings show one primary theme (*societal advancement*) and three sub-themes (*knowledge acquisition*, *problem-solving* and *informing decision-makers*) which emerged from the participants' responses, highlighting the perceived importance of research to society (see Figure 5.1).

Figure 5.1

Reported Usefulness of Research to Society



5.1.1 Societal Advancement

The theme of *societal advancement* was discussed by participants as the major overarching value that research plays in society. Specifically, it was discussed in terms of desirable changes and development of the primary conditions of society, the environment and people's lives based on society's prevailing values and goals. This advancement was reported as being achieved through three sub-themes: knowledge acquisition, problem-solving and informing decision-makers.

5.1.1.1 Knowledge Acquisition. Participants described societal advancement through knowledge acquisition, using science and the scientific method to develop valuable knowledge for the progression of society. For example, 'research should be producing something that is of use to society … so we can understand the world better and improve the way we use our resources, the way we interact with life on this planet, and each other' [INV020]. Another participant stated:

> The importance of research to society is … I would say knowledge acquisition and provide benefits in everything from human health to environmental management, to sustainability … I think without research in some form or another … our society wouldn't function in the way that it does. Certainly, wouldn't have the kind of

> technological advances that it does and understanding of natural systems that we have. [INV005]

5.1.1.2 Problem-Solving. Participants described using research to solve society's problems as being an important function that research plays in society. For example, 'I think it's critical to solving problems and improving the way we do things' [INV008] and 'I think that obviously research answers questions for society so things that society needs to know or wants to know … we know the answer [to] those questions' [INV024]. This was also reported by other participants, who stated:

> I kind of think of it in maybe very old school terms in two ways. I think about pure science which is sort of answering questions for curiosity's sake and then applied science which is in my mind trying to answer questions that society needs for practical reasons, and I think the two are intimately related. [INV028]

5.1.1.3 Informing Decision-Makers. Participants linked decision making process with influencing and informing policy as an important contribution that research makes to society. Specifically, participants discussed this in terms of using the evidence base that science affords as the foundation for policy solutions. For example, 'I think research is essential to ensure that we have really robust evidence to inform how we address policy solutions … and practice solutions in the world' [INV007] and 'Look, I think … the primary goal of research is all about generating evidence and understanding to inform decision-making and practise' [INV021]. This is supported by another participant, who stated:

> Society is always evolving … society is not static, culture is not static … the choices that are made in the public domain about how to create a strong, happy society are informed by knowledge and research is about the production of knowledge. [INV019]

5.1.1.4 Summary. In general, participants perceived that research and science contribute to societal advancement through knowledge acquisition, problem-solving and

influencing decision-makers. Interestingly, participant discussions on the usefulness of research were framed altruistically, prioritising the wellbeing and interests of society over the researcher's self-interest. This was further supported by the lack of reference towards pure science or curiosity-driven science by participants. This altruistic perspective suggests that a researchers professional identity is fundamentally grounded in and based on these altruistic values of research being a public good, driven by societal needs rather than individual gain and knowledge generation for collective benefit. However, this altruistic motivation stands in direct conflict with 'publish or perish' models and competitive funding cycles, which prioritise output metrics over broader societal impact, suggesting a fundamental shift in the perceived value and impact that science provides to society (Lee, 2014; Steingard & Rodenburg, 2023). This conflict may lead to tension and can create identity and role conflicts for researchers, potentially leading to stress, burnout, and challenges in maintaining intrinsic motivations for research. Consequently, stifling innovation, limiting our understanding of the natural world, and foregoing potential benefits that could profoundly shape the future. Such systemic pressures also carry the risk of fostering researcher cognitive inflexibility, whereby scientific inquiry becomes narrowly focused on fundable topics, thereby constraining researchers' intellectual freedom to explore curiosity-driven or foundational science.

5.2 Characteristics of Identity

To explore participants' professional identities, they were asked to describe the characteristics they associated with a researcher broadly and to reflect on the universality of these characteristics to researchers across different disciplines. This approach facilitated an in-depth exploration of the social categorisation of researchers. Some participants felt that these characteristics were the same regardless of discipline, for example, 'I think that's [fundamental curiosity is] probably common across academia in general. I suppose there is

always that pursuit for an answer … the model is always the same but how we get there we use different … methodologies' [INV033]. Another participant stated:

> Generally speaking, I think a scientist follows a method, that is declared and is repeatable and is transparent. So that other scientists can come along and essentially repeat that recipe and repeat the experiment … see if those results are consistent, regardless of who's applying the method. So, I think that's probably one of the fundamentals of being a scientist. [INV028]

However, not all participants viewed the characteristics of a researcher as being analogous with all researchers but rather viewed these characteristics as functioning dimensionally, for example, 'Like any job there is an incredibly broad spectrum of personalities and abilities out there' [INV018]. Another participant further supported this: 'I think there are a lot of different sorts of research ... I think different people view it in different ways depending on the research profession' [INV007].

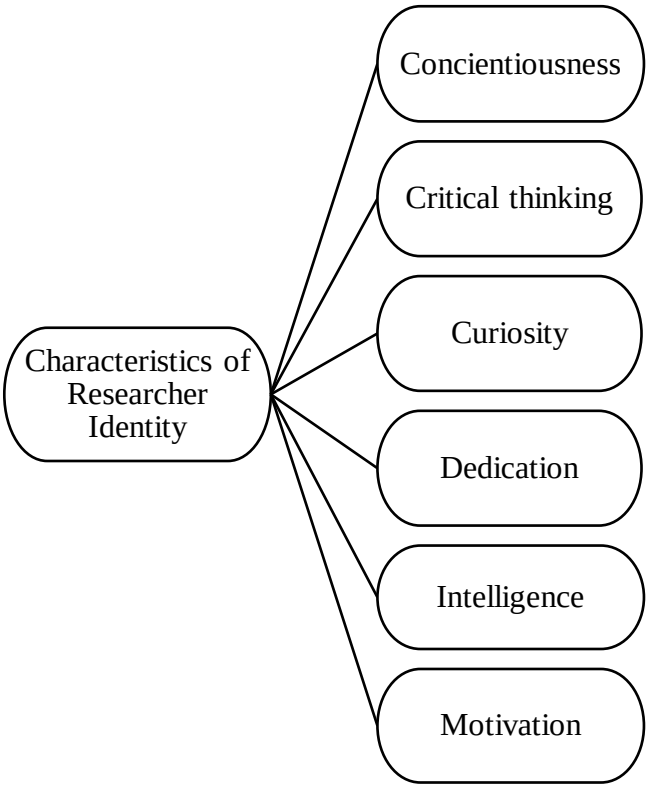
Some participants acknowledged disciplinary differences that can be seen across the breadth of research, highlighting that certain characteristics were discipline dependent; for example, 'I think there are broad characteristics. But there are some differences across disciplines' [INV014], 'I think that every research discipline has its own particular culture, its own particular language and its own way of categorising different activities within the field' [INV020] and 'different disciplines have different methodology and different ways of doing things' [INV021].

The higher-order theme *characteristics of researcher identity* captures participants' observations about what makes someone a researcher in their eyes. Specifically, participants identified internal characteristics that form part of the researcher identity. Participants' responses were coded into six main themes, representing clear descriptors of researchers' identities (see Figure 5.2). Although variability existed between responses in terms of what

participants chose to focus on and emphasise, when collated, these responses formed a distinct and stereotypical image of researcher characteristics. These characteristics also align with the typical description of a researcher in the literature (Carlone & Johnson, 2007) and can be considered to support the general societal understanding of a stereotypical researcher.

Figure 5.2

Reported Characteristics of a Researcher



5.2.1 Conscientiousness

Conscientiousness was highlighted as a crucial attribute of a researcher's identity. In this case, conscientiousness was characterised by being responsible, meticulous and diligent in the application of the scientific method and research process. For example, 'being prepared and patient to not take shortcuts, not to go to the last page of a book' [INV033]. This was described in more detail by one participant:

> I think [being a scientist] involves a commitment to looking at something empirically and trying to understand what's going on. Then being guided by the conclusions that

> you find and draw from your research. Kind of irrespective of whether or not it happens to agree with your own personal preoccupations and biases. [INV001]

5.2.2 Critical Thinking

Many participants described a researcher as someone who engages in critical thinking; for example, ‘Critical thinking is number one’ [INV027] and ‘Critical thinking … but what people are critical about and how they apply that is different, but that general idea of critical thinking’ [INV004]. A researcher is also described as possessing a critical mind; for example, ‘I think probably a second characteristic is a willingness to be critical as in to be questioning of what might seem like an obvious answer or connection’ [INV019]. This is supported by another participant, who stated, ‘and I think that’s sort of critical mind. And I don’t mean critical as criticism there but you know critique [INV013].

5.2.3 Curiosity

Curiosity was described as an integral characteristic possessed by a researcher, being conceptualised as someone who has a desire to learn (a philomath), has an inquiring mind and is motivated to seek answers. For example, ‘I think the first thing has got to be just genuine curiosity … they have to have a particular interest in something they have to have a curiosity and the desire to take the steps to address the questions’ [INV023]. This sentiment was supported by other participants who stated, ‘Somebody who is curious and seeks answers to questions about things that they enjoy learning about’ [INV006], ‘I think there’s a fundamental curiosity and we’re driven by that and I think that’s probably common across academia in general I suppose there is always that pursuit for an answer’ [INV033], ‘someone with an inquiring mind’ [INV014] and ‘I think a baseline characteristic is curiosity’ [INV019].

5.2.4 Dedication

Participants described dedication as an important characteristic of a researcher, conceptualising dedication as someone committed to being a researcher with a strong sense of responsibility towards the objectives of science. For example, ‘most scientists are passionate about what they do’ [INV029] and ‘I believe what is needed to be an effective scientist is having a real passion for a particular field’ [INV033]. Dedication also implied a persistence in pursuing the goals of science, despite the challenges and obstacles, leading to sustained effort, determination and resilience over time. For example, ‘I think maybe the fundamental issue is energy … you see the most successful people being those who are highly energised to actually solve problems and have persistence and resilience. And they’re probably the key ingredients’ [INV018] and ‘is willing to basically get up and dust themselves off because there’s lots of setbacks and research … you [have] got to be really resilient’ [INV014].

5.2.5 Intelligence

Possessing intelligence was described by participants as an important characteristic of a researcher. Interestingly, participants did not necessarily describe intelligence in terms of possessing general intelligence, instead speaking about being studious and smart enough to develop the core skills necessary to be a researcher. For example, ‘Oh well I think you have to be bright … you need to be able to study so that you have the skills required to do it’ [INV002]. Another participant stated:

> There’s also [a] scale of brilliance … from an absolute genius, to people who are competent but not necessarily a genius … But I think there [is] a place for everyone in terms of how they actually work, as long as there is a core competence. [INV018]

5.2.6 Motivation

Possessing motivation, energy and ambition to pursue research was a characteristic that participants associated with being a researcher; for example, ‘I think so … the really committed, good scientists they are ambitious, they’re focused’ [INV003] and ‘someone who’s highly motivated’ [INV014]. Additionally, motivation was conceptualised as being driven by altruism; for example ‘you need to believe that the results that potentially you will come up with will make a difference’ [INV002]. The same participant went on to state:

> I think most people are motivated by wanting to make a difference. That’s what makes a really good researcher, because that will drive them to keep going and to keep asking questions and looking at ways to answer those questions. [INV002]

5.2.7 Summary

Exploring the characteristics of identity involved examining the specific attributes and traits that participants described as constituting and defining a researcher’s sense of self. This examination identified conscientiousness, critical thinking, curiosity, dedication, intelligence and motivation as key characteristics contributing to participants’ self-perception and, consequently, to a researcher’s professional identity. These findings align with existing literature, suggesting that fundamental qualities are commonly associated with individuals’ identities as researchers (Carlone & Johnson, 2007; Dou & Cian, 2022). Moreover, this supports many stereotypical characteristics of researchers, highlighting the influence of social and cultural factors on identity formation and expression. The fact that many participants felt these characteristics applied to researchers regardless of their discipline suggests that researchers conceptualise themselves as part of a larger in-group. Identifying more with the overarching principles of science, such as the scientific method, rather than with their specific discipline or other possible roles, such as academics.

5.3 Identity Formation

The formation of researcher identity was investigated by posing questions to participants regarding their self-perception as researchers and integrating this identity into their broader sense of self. Participant responses illuminated the self-categorisation process into the researcher in-group and the social identification associated with being a researcher. Analysing these factors offers a comprehensive understanding of how researchers develop their professional identities and the various influences that shape this process over time.

5.3.1 Professional Identity Development

Participants discussed the process of professional identity development as a complex and transformational process of internalising the core knowledge, skills, values and beliefs of the profession. For example, 'I think it's someone who is qualified [as a researcher] so it's not necessarily that you need to have a PhD, but I think you do need to have been involved in conducting and publishing research' [INV008]. Another participant stated:

> I think someone needs to have some formal scientific training … there's no doubt before they can be called a scientist … But more importantly you need to be exercising that scientific method, in trying to understand the world around you. They are not necessarily mutually inclusive but mostly they are [INV032].

This process of professional identity formation results in individuals acting, thinking and feeling like a member of that professional community. For instance, many participants described using the scientific method as a key aspect of *being a researcher*, suggesting this is substantially linked to a researcher's professional identity. For example, 'obviously using the scientific method … I regarded scientists as somebody who actually does science … to me a scientist is somebody who's actually still actively involved in research' [INV011] and 'someone that exercises the scientific method and is trying to ask and answer question, that's what a scientist is' [INV032].

Furthermore, this process was also described as providing legitimacy and solidifying their value and worth as a researcher:

> I've gained legitimacy as a scientist through getting my PhD under people who are considered very good scientists. And I remember earlier this year I got an NHMRC investigated grant [I thought to myself], I've proven to them that I'm a scientist. [INV012]

These results support the literature describing professional identity development, which indicates that professional identities develop as a function of learning about the profession. It is interesting to note that this *requirement* is looked for by participants when conceptualising what a researcher is, suggesting that there is a process of in-group and out-group identification in addition to categorisation.

Interestingly, participants discussed the core elements of being a researcher. For instance, some participants describe this curiosity as something that researchers are born with: 'That innate need for inquiry … I can't overstate that the importance of that inquiring mind' [INV009]. This participant goes on to describe what this looked like for them growing up:

> I think I was born that way … my parents used to call me the 'but why child' … one of those kids who follows you around and wants you to explain complex physics at three. So, I think you can certainly teach research skills and I have learned an awful lot over my career. But I think there's a fundamental, and almost innate curiosity, in active and sustained research. I still am [a but] why person. If I see something I really want to try and understand why that might be. [INV009]

If these are core elements of being a researcher, which participants seem to indicate, then perhaps there is only so much scaffolding in the development of professional identity that organisations can do to foster the development of a researcher's professional identity.

Importantly, participants described role conflict associated with their interpretation of the professional identity as a researcher. Specifically, participants spoke to the notion of struggling to identify as a researcher owing to the multiple roles associated with academia. That is, while others might identify them as researchers, they identify as academics. This conflict can also be seen in the following conversation with one participant:

> **Participant INV031**: I think I suffer a little bit from imposter syndrome … anyone can ask questions. It is about what you do with those questions … When people ask what I do, I don't know that I would even call myself a researcher. It's one of those things I've done research … but I still don't necessarily see myself as a researcher per se.
>
> **Interviewer**: So, what do you see yourself as then?
>
> **Participant INV031**: I just use broad term academic. It's kind of, I do a bit of everything, I don't do enough of [anything] … a researcher for me is someone who's pretty much that's their….
>
> **Interviewer**: exclusively doing research.
>
> **Participant INV031**: We do have academics here that, that is all that they do [is] research. It's about publications, it's about constantly going out there with those big research grants. Which I would love to, but I just don't have the time to outside of teaching and that sort of stuff. When they talk about that balance profile, I do kind of do the teaching, the research and the engagement. It's a three-pronged approach but more broadly I would call myself an academic versus a researcher.

Participant responses demonstrate that professional identity develops through engagement with the profession and is a transformative process of internalising the knowledge, skills, values, and beliefs of the profession. With many viewing the scientific method as central to researcher identity, with this process reinforcing their legitimacy and

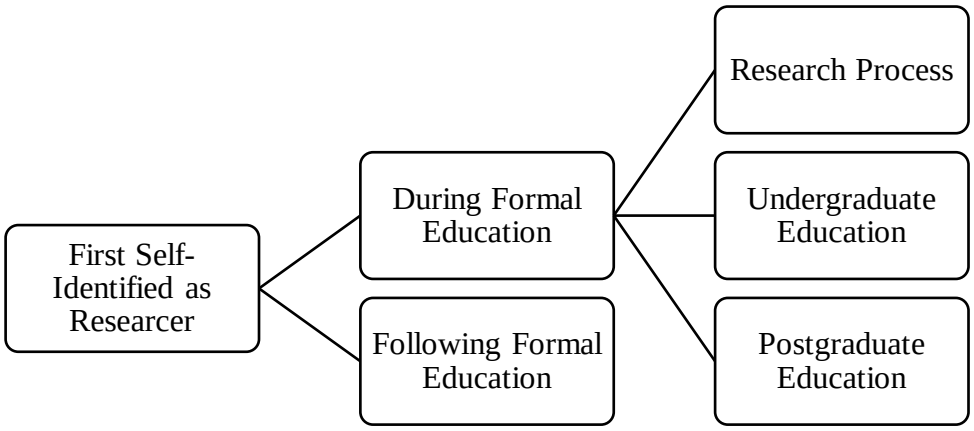
sense of worth within academia. However, participants also framed researcher identity through an in-group/out-group lens, suggesting that innate traits, such as curiosity, may limit the extent to which institutions can scaffold identity development. Furthermore, participants experience role conflict, often identifying more as academics than researchers due to competing demands in academia, highlighting tensions between research, teaching, and administrative responsibilities

5.3.2 Embodiment of Researcher Identity

To further elucidate participants' social identification with the researcher profession, participants were asked to identify when they first perceived themselves as researchers. This was designed to investigate when and how individuals fully internalise and exhibit the identity associated with being a researcher. Most participants stated that this identification emerged at some point during their formal training (see Figure 5.3). However, several participants noted that they did not truly *feel* like researchers until they were professionally employed in a research role.

Figure 5.3

The Point at Which Participants First Reported Self-Identifying as a Researcher



5.3.2.1 During Formal Education. Participants articulated that their initial conceptualisation of identifying as researchers was closely tied to their experiences of

learning about science. This association was particularly evident during their engagement with the research process, during their undergraduate education and during postgraduate education.

5.3.2.1.1 Research Process. Participants described that they first felt like a researcher when actually doing research, specifically, when they started doing their own independent research:

> It's when you first start doing independent scientific work, no matter how modest at the time. [It is] probably already when we were students. It is definitely when we started thinking about being scientists and getting enjoyment out of doing scientific work. That started really in university … very early on. [INV003]

With another participant stating:

> When you start doing honours, and you have your own project. I think that's probably the first time that I felt that I was actually being a scientist. Because to be a scientist I think you need to be trying to inquire and understand and develop new knowledge. So that's the first point where really you start to do that. Then by [PhD] time I felt like I'm a scientist. [INV029]

The embodiment of a researcher identity was also described by participants as occurring when they first published a paper and was conceptualised as a rite of passage for a researcher: 'Publishing your first paper—I think researchers publish' [INV020]. Another participant agreed, stating that 'I think probably when I first published a paper' [INV013] but then went on to say, 'I mean … it was a lot of seeing your name on paper' [INV013]. Another participant supported this sentiment, saying:

> I suppose when it first proper hit was when I published my first paper. That was like, I don't know how else you define a scientist. I'm the first author on a paper, that's out

> there for other scientists [to] read … like shit [i.e. wow!]. I'm a scientist. I took a lot of pride in that. [INV016]

5.3.2.1.2 Undergraduate Education. Some participants first described feeling like a researcher during their undergraduate education. For example, 'Oh, I would say I felt like I was doing research when I was doing my honours degree … I felt like an independent researcher at that moment … I felt a lot more comfortable in that space' [INV021] and 'I guess for me. I felt when I started doing my honours work that's probably when I really felt I would become a scientist … applying the scientific method and developing new knowledge' [INV025]. Another participant stated:

> I guess probably third year of undergraduate. I started doing research on small projects. So, I don't know that I would necessarily call myself a researcher at that time, but that's probably when I started becoming an official researcher. [INV006]

Yet another participant stated:

> As an aspiring scientist, in the latter part of my undergraduate time say third/fourth year at uni. I was also doing some research and I wrote up several studies that I did. Although I didn't end up publishing … it was just all [a] learning process, how do you write a scientific paper and all that. [INV001]

5.3.2.1.3 Postgraduate Education. Additionally, many participants described feeling like a researcher during their postgraduate year, for example, 'I think when I did my Masters and you know did my first sort of independent research project' [INV005]. While yet another participant stated, **'**I became a researcher when I did my first piece of real research which would have been my masters' [INV014].

Most participants describe first feeling like a researcher 'when I started doing my PhD research' [INV015]. Another participant described:

> PhD. … I feel like the PhD process permanently changed my brain and the way in which I view things. It just sharpened that critical thinking. It's that critical thinking really, that makes you the researcher … the way in which you view the world, but yeah during the PhD. [INV004]

Some participants describe the process of being awarded their PhD as the point at which they considered themselves to be a researcher: 'I probably wouldn't have considered myself a scientist until I had completed my PhD' [INV008]. Interestingly, some participants describe this process of being awarded a PhD as being an objective validation of them becoming researchers. One participant stated:

> When I actually stood up there and I got my PhD … I felt then that I had attained a qualification that objectively described me as a scientist and a researcher. At that stage I was happy to call myself a researcher. [INV032]

5.3.2.2 Following Formal Education. While many participants described first feeling like a researcher during their formal education, some stated that they did not feel like a researcher until they were employed and working as a researcher: 'So it probably it was really that first real job' [INV029]. One participant described this process as being more ambiguous:

> Probably not until a couple of years into [my current research position]. It's not that I didn't feel like a researcher in [another country] but I definitely was proud to call myself a practitioner slash researcher. And I would like to be able to do that again. I think after a couple of years in an academic job, it's very hard to lay claim or at least given the sort of work … very hard to lay claim to that practitioner role anymore. That's something I regret. But I would say that when I'm asked to characterise what I am or what community I represent these days, I would sort of maybe the last two years, I would say definitively I'm a researcher. [INV019]

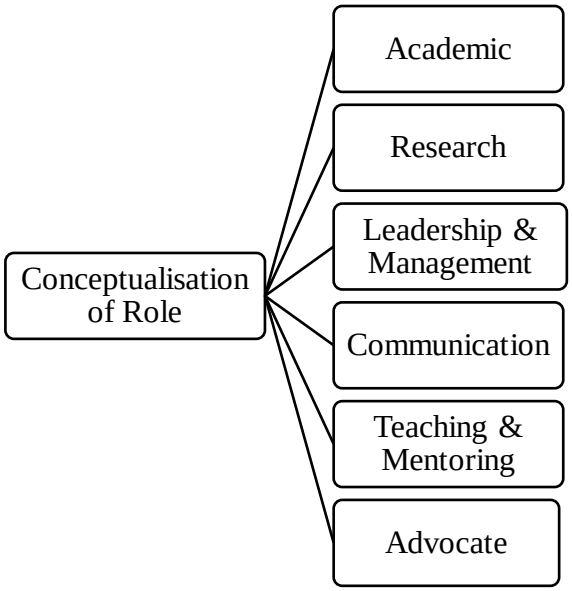
5.3.2.3 Summary. Participant responses suggest that the transition to identifying as a researcher is not marked by a singular moment but rather represents a gradual development of professional identity, often culminating in the completion of their highest level of formal education, which for this sample was a PhD. The variability in the point at which participants first felt like researchers, whether during undergraduate or postgraduate studies, may be attributed to disciplinary-specific differences and the timing of engagement in the research process specific to each field. Nonetheless, these findings align with the broader professional identity literature, which indicates that professional identity formation occurs progressively throughout the training process (Adams et al., 2006; Ligorio, 2010; Quartiroli et al., 2021).

5.3.3 Conceptualisation of Researcher Roles

To further investigate the identity formation of researchers, participants were asked to define their professional roles as researchers. This was designed to understand how they perceive and articulate their responsibilities, functions and contributions within the scientific community and society. Additionally, this exploration provided insight into the process of self-categorisation, the internalisation and self-conceptualisation of the researcher identity, and the associated social norms and roles. Understanding these aspects is necessary for exploring how researchers conceptualise their professional roles and the factors influencing their perceptions and actions throughout their careers. Participant responses were categorised into six primary themes, as depicted in Figure 5.4.

Figure 5.4

Roles Reportedly Associated with Researcher Identity



5.3.3.1 Academic. Participants used the blanket term *academic* to encompass many facets of what they considered their professional role to be. One participant described themselves: ‘I’m an academic that does research and does teaching and so I guess if you ask me what my job is I’m an academic with that mixed portfolio and therefore those mixed responsibilities and mixed focus’ [INV032], with another participant stating, ‘teaching, research academic position’ [INV015]. Another participant supported these sentiments: ‘I just use broad term academic and it’s kind of, I do a bit of everything’ [INV031].

5.3.3.2 Research. Participants unsurprisingly described their professional roles as encompassing a commitment to the pursuit of knowledge, a rigorous approach to inquiry, and a dedication to contributing to the scientific knowledge base. For example, ‘I’m a researcher’ [INV014], with another participant stating, ‘I would say definitively I’m a researcher’ [INV019]. Other participants also described a researcher as being someone who actively *does* research. For example, ‘They are actively collecting data, analysing the data, publishing that data in respected, you know, reasonable standard of scientific literature also if they are taking

part in the community that participating in the community of research' [INV020]. This is further expanded upon by one participant who describes the process of learning about the scientific method as contributing to what makes someone a researcher. For instance:

> I think a scientist follows a method that is declared and is repeatable and is transparent. So that other scientists can come along and essentially repeat that recipe and repeat the experiment and see if those results are sort of consistent regardless of who's applying the method. So I think that's probably one of the fundamentals of being a scientist [INV28].

Interestingly, participants discussed not just research in a broad sense but described translational research, suggesting a shift towards research that has more specific practical applications for improving society. For example, 'In my research capacity my role is to work with … stakeholders. [To] understand what their research priorities are, develop research, do it and then ensure the translation of that into practice' [INV017]. Another participant stated:

> My professional role is to develop major science programmes, that link the scientist, the research, with end users and industry to end up produce[ing] new knowledge that hopefully will have some sort of translational change to industry. So, I'm not a basic scientist anymore … early on I think … a lot of scientists do start out [on] just blue-sky type projects but I'm very much now towards the spectrum of wanting to conduct science that has impact. [INV029]

The same participant discusses their professional shift in more detail, emphasising a shift from curiosity-driven science and underscoring a potential fundamental shift in the perceived value and societal impact of scientific research:

> It's been a very clear evolution in the way I approach and think about things. I have a much more commercial science brain now, than I did say 15 years ago. I was really focused on just generating the science knowledge 'cause that was interesting but not

> necessarily thinking about where it's placed in having impact. Where[as] now I see the problem and then I work backwards. [INV029]

5.3.3.3 Leadership and Management. Participants describe leadership and management as roles they undertake within their researcher professional identity. Specifically, this was defined as involving a combination of strategic oversight, effective communication, resource management and guiding other researchers in their scientific endeavours. For example, 'I do a lot of research leadership' [INV021] and 'I see my role more and more as a capacity building role, you know, capacity building at a department level but also capacity building at the student level. So, you're growing the next generation of researchers really' [INV002]. Another participant described themselves as a research manager: 'My professional role, I'm a research manager … so I manage research programs' [INV007]. Other participants described their role as having changed to incorporate more management responsibilities: 'Now I probably have more roles that are kind of management roles. You know I'm less kind of individual research [focused] so you know, helping other people to do their research coordinating, that sort of thing' [INV005].

5.3.3.4 Communication. Participants described the importance of being a communicator when discussing their roles as researchers. Specifically, communication was described as conveying scientific knowledge, research findings and technical information to various audiences, both within and outside the scientific community. For example, '[I am employed] to teach, to research, to generate new knowledge but also to engage with the wider community [either] in a teaching or research capacity, or just a broader public communication capacity' [INV027] and 'I think the important thing is to publish the results and then it can

contribute to sort of the broader, you know, the broader body of research knowledge' [INV005]. This was further elaborated on by another participant, who stated:

> I probably see my role as providing information regarding the status and wellbeing and requirements of aquatic fauna. I feel like my job is to try to provide information that not only helps to protect those natural ecosystems but, in some way, tries to help society to have an opportunity to appreciate things they don't necessarily get to see on a day-to-day basis. So I guess ultimately, I see myself as someone who provides information about the environment for societies use. [INV028]

Participants discussed the evolving role of science communication in society, highlighting a transition from fundamental, curiosity-driven science to applied science. This discussion underscored changes in science funding, reflecting altered priorities and economic conditions. For example:

> Increasingly, it's become such that you've got to be more publicly accountable… there's more public interest in what scientists do. And I think that's in some ways that's a bad thing because it means that some purely curiosity-driven research is not fundable. But the other thing is, it just means that scientists have to be able to communicate to a broader audience in a way they didn't when I first started. So, back then, people who talk to the media or people who write magazine articles were the exception rather than the rule. And to be honest, I found people who did applied research or did try to communicate with the public—other scientists looked down on them. Somewhere around the 2000s... the way science is funded started to shift and the people who communicate to the public, who had a profile started to be more successful at getting funding. [INV023]

5.3.3.5 Teaching and Mentoring. Predictably, many participants discussed teaching and mentoring as being a focus of their current role as researchers. For example, 'I have to

mentor young scientists [who] have got a PhD now' [INV010], with another participant stating, 'I really love teaching' [INV013]. Participants also described themselves as 'the academic adviser for the undergrads' [INV011] and the 'teacher of undergraduate students … adviser for people like yourself in HDR zone' [NV014]. Furthermore: 'I find myself in an academic head role where there's less opportunity to actually do the research myself but there's great opportunity to support the next generation coming through' [INV002], and 'my job is to train other people to be scientists and to evaluate… just keep on doing science well. I think that's my role' [INV024]. Lastly, 'but also training new researchers and as my role [as] head of school, it's about again training researchers and people in our school and teaching people about, research knowledge, translation pathways' [INV017].

5.3.3.6 Advocate. Some participants explicitly describe themselves as having an advocacy role or an advocacy side of their professional researcher role, with advocacy being discussed in terms of actively speaking up for specific causes and raising awareness of these causes using scientific knowledge and expertise. For example:

> Also I do definitely have an advocacy side … I don't think humans should have all of the votes about how the world is used. How do we get a voice for a whole bunch of biological entities, animals that don't have a voice. So, it kind of comes back to Singer's [Peter Singer] early philosophical work, in the early 70s, about species rights and their rights on the planet, and a whole bunch of ecosystem services, not just what serves humans first. That is obviously a very unpopular view with the majority of humans on the planet, and so that poses a major dilemma for me in my professional capacity. [INV028]

Some participants describe research and advocacy as two separate but interconnected elements. For example, 'my professional role I'm a research manager so I managed research

programs and which also includes research on advocacy and I'm an advocate' [INV007]. This participant then goes on to describe:

> I think I'm a researcher and an advocate. I make sure that I do robust research to inform advocacy, and I do research about advocacy. But fundamentally, my mission is to try and make a difference and to improve society. That's my priority, and I think research and advocacy are tools to do that. [INV007].

This suggests that although some participants conceptualise advocacy as being associated with their professional roles, there is much less clarity around how this should factor into their professional roles as researchers. Furthermore, participants described this as a role conflict associated with advocacy and their professional roles; for example, it 'poses a major dilemma for me in my professional capacity' [INV028].

5.3.3.7 Summary. Participants described various roles they perceive themselves as encompassing within their professional identity as researchers, including academic, research, leadership and management, communication, teaching and mentoring and advocacy. These were viewed as differing roles within a researcher's identity rather than as distinct identities. This extends previous research, which does not clearly differentiate between identity and roles but instead discusses these concepts synonymously (Berry et al., 2006; Chen & Reay, 2021; Ibarra & Obodaru, 2016). The present findings indicate that individuals experience diverse roles within their researcher identity, which may evolve, especially in traditional research activities such as teaching and conducting research.

Together, these findings suggest that the development of a researcher's professional identity aligns with existing literature (Barnard, 2019; Mantai, 2019a, 2019b; Marvasi et al., 2019; Tomlinson & Jackson, 2021). Additionally, regardless of disciplinary background, participants exhibited comparable views on their professional identities and perceived the

societal value of their profession similarly. This consistency across disciplines indicates a uniform understanding among participants regarding their roles as researchers.

5.4 Enduring Stability of Researcher Identity

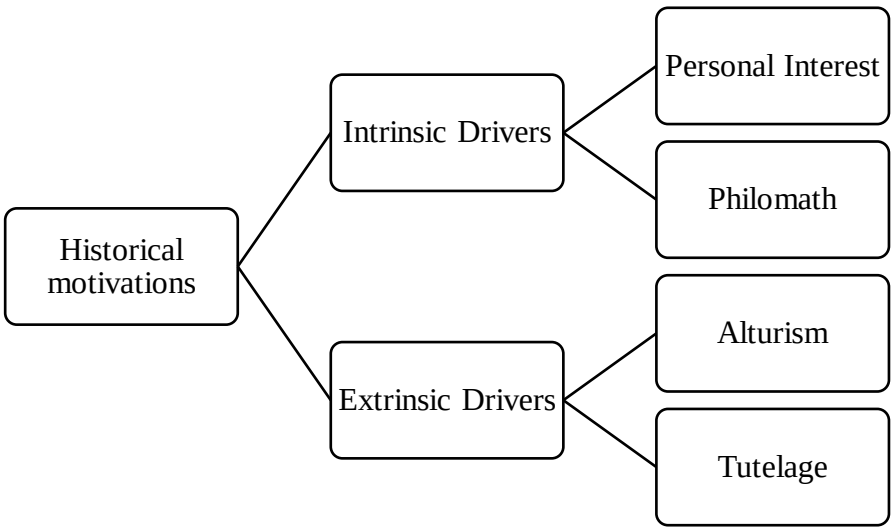
To further explain the nuances of participants' researcher identities, the stability of their identities was explored. The sustained and consistent sense of being a researcher, that is maintained over time, was explored by asking participants about their historical motivation for pursuing research and their contemporary motivations to remain in the profession.

5.4.1 Historical Motivation

Participants were asked what motivated them to pursue research for the purpose of exploring participants' social identification with the discipline of science more broadly. Four main themes emerged from the participants' discussions (see Figure 5.5). While these themes, when considered together, demonstrate the variability within responses, they represent a coherent narrative centred on similar specific drivers for pursuing research. Importantly, most participants articulated multiple motivations that spurred their engagement in research activities.

Figure 5.5

Historical Motivators that Drove Participants to Move into Science



5.4.1.1 Intrinsic Drivers. When discussing their motivations for pursuing a career in science, participants highlighted intrinsic factors that were personal and internalised. Further analysis revealed two primary themes as the core intrinsic drivers reported by participants: *personal interest* and *philomath*.

5.4.1.1.1 Personal Interest. Many participants reported their passion for and love of the environment as a key driver for their pursuit of science. It is important to note that this theme is a specific reflection of the sample, largely consisting of those from environmental science backgrounds. However, it speaks to a broader sense of curiosity, learning about science and personal interest within researchers more broadly. For instance, 'I've been fascinated by the ocean, since I was a child' [INV025]. This sentiment was supported by other participants, with one stating:

> Growing up, I always was drawn to nature and animals and the environment and so forth. I grew up on a Mediterranean island and loved it and loved animals. So, I ended up studying biology, that was always something that I wanted to study at university. I didn't really know what I wanted to do, but I just knew that that was what motivated me. Then when I finished university, right before I finished my undergraduate, I did a semester abroad in an island in the Caribbean and I studied Marine Environmental Science and fell in love with it. [INV015]

Many participants reported that they felt this love of nature and a drive to pursue this in some way, from a young age: 'I grew up fascinated by nature by animals especially … I think I announced to the family when I was three that I was going to be a biologist and it was a very clear path from then on' [INV027].

5.4.1.1.2 Philomath. Many participants also reported their love of learning as a key driving force behind their motivation to move into research: 'I was just always really

interested in evolution and natural history. And that's what kind of got me into this' [INV011]. Similarly, another participant reported:

> For me, it all started as an intellectual passion. From when I was a kid I've always loved science, I've always been super curious and for no specific reason. I just gravitated towards the ocean and sharks. I just quite literally thought, Oh, my God! These are the effing coolest animals on the planet. I was just so enamoured by them. Maybe it might have been because I was a boy and boys like scary looking animals, I don't know. But that's quite simply how I fell in love with sharks, the ocean and that kind of became one of the avenues through which I explored my passion for science and curiosity. [INV016]

Participants described possessing a love of learning from a young age, with one participant stating:

> I think I've [been] pretty fortunate that my dad years ago used to take me fishing and camping nearly every weekend with the family [and] with friends. I think that outdoor lifestyle and that natural environment, just that curiosity, I suppose that was always there. That was probably the really start of it in wanting to pursue answers I suppose. [INV033]

5.4.1.2 Extrinsic Drivers. When describing their motivations to pursue a career in science, participants identified extrinsic drivers relating to external factors and incentives as motivating them. Two primary themes emerged: *altruism* and *tutelage*.

5.4.1.2.1 Altruism. Many participants discussed that they pursued research for altruistic reasons. These reasons were predicated on a desire to make a difference in society. For instance, 'I think the purpose of research is to make the world a better place' [INV013]. While another participant described their reason as, 'I am focused on making a difference to society and improving society, and I see research as an essential component of that as well as

a tool to be able to do that more effectively' [INV007]. This altruistic drive to pursue research is unsurprising given previous research highlighting the importance researchers place on making a difference in society.

5.4.1.2.2 Tutelage. Participants describe the importance that social influences can have on shaping their career in research, specifically, having a mentor or someone to look up to. For instance, 'To a large degree, I suspect it's being determined by a few good people who have acted as mentor in the life of a young person [me] and who gave them [me] a vocation' [INV010]. This is supported by participants who explicitly stated the important role their mentors had in their development and guidance towards research. For instance:

> I went to uni planning to be a psychology major. In my first semester I took Intro to Psychology, and I took a first year Sociology class that was called Deviance and Society. We basically just… watch the Matrix and read The Handmaid's Tale. I hadn't known what Sociology was before that, and I just went—I'm hooked! My professor in that class was very [supporting saying] you [have] got to go on to grad school, you got to go on and do research. [It was] a whole different plan and she wanted me to go to Boston University and work with her supervisor. [INV013]

Another participant stated:

> She asked me, what do you want to do with your degree—Do you enjoy lab work? And I said, no, I hate it. I want to make a difference. And she said, well, then don't do straight biology because you'll never be able to make a difference, you should look at the human side of things, the social side of things. [INV015]

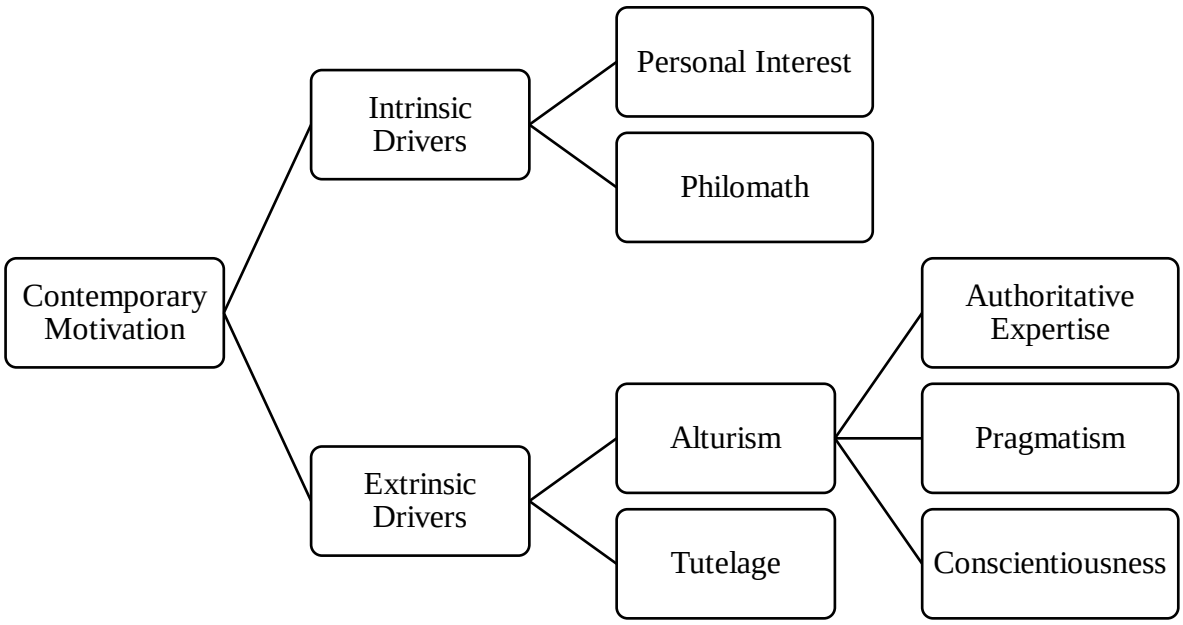
5.4.2 Contemporary Motivation

To ascertain participants' conceptualisation of their current roles as researchers, they were asked about their current motivation or the current focus of their careers. The analysis identified two primary themes with associated sub-themes (see Figure 5.6). These themes and

sub-themes are interconnected and frequently co-occur rather than existing in isolation. Moreover, participants commonly articulated multiple motivators rather than singularly focusing on one.

Figure 5.6

Contemporary Motivators that Drove Participants to Move into Science



5.4.2.1 Intrinsic Drivers. Similar to the previous section, participants described intrinsic drivers relating to personal motives to continue doing research and to continue working in the profession of science. Again, two primary themes emerged: *personal interest* and *philomath*.

5.4.2.1.1 Personal Interest. Participants identified personal interest as a driver which persisted in motivating them to continue as a researcher and conducting research. This was specifically conceptualised as a passion for and love of the environment. For example, ‘I love learning new things about sharks and I’ve done that throughout my career, I’ve done some

really fascinating stuff and really learned some really interesting things. So that's one of the motivators' [INV025].

5.4.2.1.2 Philomath. Participants discussed a love of learning as an important motivating factor for them to remain a researcher: 'That is what is inspiring me to continue in this space because I actually think that there are some huge gaps some fundamental gaps in our knowledge that need to be plugged' [INV021] and 'There's the inherent desire to, I guess, answer a questions or to understand the situation properly so it's kind of the puzzle, so to speak, or, you know, solving the riddle' [INV023]. This is expanded upon by another participant, who stated:

> I enjoy the freedom of being able to come up with questions and then seeking answers for questions. I guess there is some level of professional freedom in terms of the areas that we pursue, the questions that we ask and the way in which we conduct our work. There's… a lot of flexibility and freedom for that and I like learning. [INV006]

5.4.2.2 Extrinsic Drivers. As discussed in the previous section, participants identified external factors and incentives that motivated them to continue researching and working as researchers. Again, two primary themes emerged, with corresponding sub-themes: *altruistic* (authoritative expertise, pragmatism and conscientiousness) and *tutelage*.

5.4.2.2.1 Altruism. An overarching theme of altruism was identified by participants, which was described in terms of motivation driven by a genuine desire to benefit society. Altruism was further conceptualised in three ways: *authoritative expertise*, *pragmatism* and *conscientiousness*.

Authoritative expertise was discussed in terms of being an expert voice and using this platform to achieve certain aims, such as correcting misinformation, and was described as being an important motivator for participants to continue within their professions as researchers:

> Particularly with [contentious issue] there's so much misunderstanding and this misunderstanding leads directly into decision-making. Which quite literally affects people's lives. So, that's one of the main motivators, that there is this misunderstanding. That there is this desire by the general public, quite genuinely I think. But [contentious issues] have a very powerful way of engaging people's curiosity, for better or worse. And what motivates me is that I'm a scientist. I know [contentious issues], I know people who know [contentious issue] and I know so many scientists who have specialties. I want to get this knowledge and give it to people and say, hey, this is actually what's going on here. There's so much we know but there's so much more we don't know. So can we use this to make the best decisions possible. [INV016]

The same participant goes on to describe the responsibility they feel to be the expert voice in their particular area of expertise:

> And I feel the degree of responsibility for that. Because I've been fortunate with an education, fortunate with my career opportunities, fortunate with the knowledge that I have that the very least I can do is help. I'm extremely fortunate that I get paid to do that which is incredible. So yeah, that is my motivation at the moment, you know, there is such a misunderstanding. And I supposed it's the motivation of wanting to be an educator and a communicator. And there's also the frustration of, the world's in trouble. We have answers, we have the resources, we have the talent to fix these issues. Myself, along with our organisation and along with many other talented people in the world need to make sure this happens. [INV016]

Participants identified *pragmatic* drivers, specifically a commitment to effecting positive societal change, as a significant motivating factor for their continued engagement in research. They perceived this pursuit as the primary means through which they could achieve

the changes they deemed important and aspired to realise. For example, a participant noted: ‘Fundamentally my mission is to try and make a difference and to improve society. That’s, my priority, and I think research and advocacy are tools to do that’ [INV007]. Another participant stated:

> The reason I went and got my PhD, I thought anybody can scream about environmental destruction. But if you got the PhD attached to your name, you’re more likely to be listened to by people that count like journalists, and others and NGO people and all those. So, I think that was the key motivation. I just think I’m very interested, sincerely very interested in environmental conservation especially in the tropics of course. [INV001]

Another participant also stated:

> Well, I mean, what motivates me to continue with research is where I see gaps and where people have said there are gaps … I’m very much focused on equity. So I tend to work at that sort of interface. I guess at the margins, where you say we’re going to get the greatest gain. So, I tend to work in under resource settings, poorly resource settings, under-served populations. So, I will do a lot of work with Aboriginal, and Torres Strait Islander People and I work in low income settings. [INV017]

Some participants expanded on this, stating that they do research that helps people: ‘doing research that leads to applied outcomes, doing research that needs to be done, doing research that has an impact on people’s lives and industry’ [INV020], with another participant stating:

> I really want to have impact. I don’t care about publications so much anymore. The three things that drive me are: I want to have impact and what I do can be measured somewhere out in society, [I am] very passion about training the next generation of scientists and ensuring that they have everything they need and … third is what you

> mentioned around advocacy. I want to make sure that the public understands and particularly related to my field say aquaculture, what are the real benefits, why is this something of importance. [INV029]

This is elaborated on by one participant, who stated:

> To be a researcher … I want to change the narrative around certain things that I think are important and that dominate scientific research and make it less impactful than it should be. So, I work in rural communities, in developing countries, mainly in small islands in the Pacific. There's a lot of Western ideals of conservation and development that are imposed on these communities. A lot of money that's spent and trying to, help them and it doesn't lead to the outcomes that they need or want or any of that. And so, I guess it's really less about publishing papers and more about just changing the way people do applied research. [NV015]

Interestingly, one participant describes research as a tool that can be used to achieve the greater goal of making positive change: 'I came into research, not really being passionate about research it was really opportunistic. I now see that it's actually a really important part of what I want to do in order to achieve a bigger vision' [INV007].

Participants discussed *conscientiousness* in terms of a desire to do good quality science as an important motivating factor for them to continue to be a researcher. For example, 'Be driven by and really motivated by and inspired to do good research' [INV007]. This is elaborated on by another participant, who stated:

> I think that I'm still interested in questions and mechanisms and how things work. I guess when you know environmental things are important, and you know bad things are happening to the environment, and I feel concerned that a lot of people draw conclusions from very poor sources of evidence. So, they use anecdotal things, they use their own personal experience, they use something they once observed, which I

> guess is their own personal experience, to draw conclusions about what's going on. And then, they proceed as if those things were true, and I really don't like that. I really think that we should test all these notions. So, I see my role [a] little bit [like a] gatekeeper. That we would look at actually test[ing] these mechanisms that people say are happening, rather than just saying there happening and proceeding as if they are. A lot of people are like 'oh no we are conservation biologists, and we don't have time for all that science, we've just gotta save this animal' and again leads to perverse outcomes. So, I feel like I have the skills, and the knowledge, the ability to actually test things. So, I feel like I want to test things, and I want to tell people that they should test things so I want to teach students. [INV024]

5.4.2.2.2 Tutelage. Mentoring and supporting the next generation of researchers was an important motivating factor for many participants. For instance, 'There's great opportunity to support the next generation coming through … and I love doing that because it's about just building their capacity' [INV002]. Another participant described that mentoring students provided them with motivation within their professional capacity:

> I also coordinated the master's degree and have a lot of PhD students. So, it's in those roles where you start to see the students who are finished their undergrad degree and now they are sort of wanting to learn and move off into research or onto academic pathways. So, I think I get a lot of motivation from helping them, seeing them grow and move on. [INV022]

5.4.3 Identity Stability

Several participants specifically described the continuity of their sense of self over time when reflecting on their historical and contemporary motivations with respect to pursuing science. Specifically, many participants report that their motivations had not changed from what first drove them to move into science and research, with participants

reporting: ‘Look it hasn’t shifted much’ [INV003] and ‘I don’t think so … it’s [my motivation is] probably the same, yeah, I think it is the same’ [INV013]. These responses speak to the temporal stability of the researcher professional identity. While researchers’ professional identities appeared quite stable, several participants did report role conflict experienced within their professional identities as researchers. For example:

> I’m cognisant of the fact [that] I spent 14 years as Head of School or Dean. There was a huge demand, time wise, with administration. But I never really lost my research life completely, although it became more and more taxing to do that… that young man sort of desire to do research hasn’t disappeared. [INV018]

Another participant stated:

> In the last two or three years I have very much become much more selfish. So, my experience up to now have been much more altruistic, and more aimed at trying to be a benefit to society, particularly when I have worked on rare and threatened species. A lot of that stuff, it’s kind of easy to justify to yourself that you were doing something useful because these animals are in trouble. It’s much harder to confront a decade or two later that I probably haven’t actually changed anything, and that I probably haven’t had positive impact. I’ve just sort of really observed what’s going on. So that’s a little bit confronting. In the last few years, I have started to do a lot more work around animal behaviour for my own interest, just for my own pleasure. [INV028]

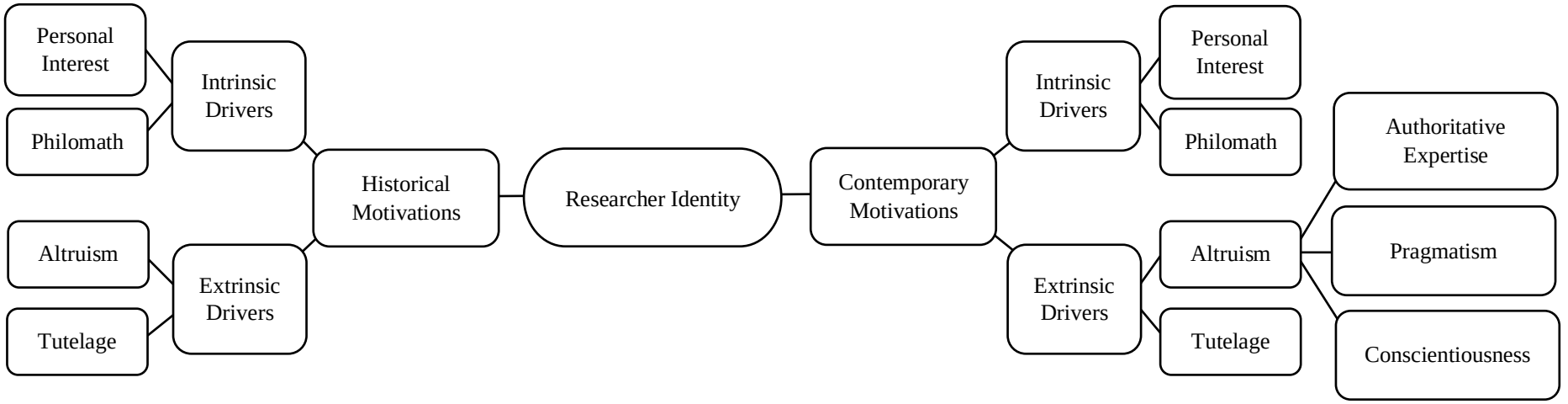
5.4.4 Summary

Overall, participants described their initial motivations for entering research and their current motivations for continuing as researchers in similar ways. Altruistic reasons (e.g. a desire to make a difference) and individualistic reasons (e.g. enjoyment of nature and a love of learning) were commonly reported as driving factors both at the outset of their careers and as ongoing motivators. These findings suggest that participants exhibit high identity stability,

meaning that their understanding of themselves as researchers remains relatively unchanged over time, providing a coherent and enduring sense of self in relation to their professional identities (see Figure 5.7). This indicates that individuals motivated by these factors in their youth would be more likely to enter and remain in the field of science, potentially achieving success. Participant responses support the concept of enduring stability of researcher identity, which implies that despite changes in external circumstances, career stages or specific research projects, the individual's core identity as a researcher remains stable and resilient. Factors contributing to this enduring stability include a deep-seated commitment to scientific inquiry, persistent engagement in research activities, and a continuous identification with the values and norms of the scientific community. This stability is crucial for professional development, career satisfaction and the ability to adapt to evolving challenges and opportunities within the research field.

Figure 5.7

Professional Identity Stability Over the Lifespan



5.5 Conclusion

Overall, participants articulated a professional identity as researchers in remarkably similar terms, reflecting a stereotypical view that aligns with Western societal norms of what constitutes a *researcher*. This consistency suggests a well-defined and widely recognised professional identity within the scientific community. Furthermore, participants described the development of their professional identities in ways that align closely with existing literature on the subject, indicating a shared understanding of this developmental process (Adams et al., 2006; Dou & Cian, 2022; Grimalt-Álvaro et al., 2022; Spiro, 2012). The stability of a researcher's professional identity was evident across different participants and throughout an individual's career, underscoring the robustness and longevity of this identity.

These findings suggest minimal variation in how researchers perceive their professional identities; however, variation exists in conceptualising the roles researchers should and are expected to undertake within society. Participants frequently discussed role conflict and the evolving nature of science, reflecting a lack of consensus on specific roles. This ambiguity regarding the roles researchers should play may explain the diverse approaches to science communication observed among researchers. Specifically, it may account for the differences in why some researchers choose to engage in advocacy while others do not. These nuances will be explored in the following two chapters.

Chapter 6: Science Communication Responses

As discussed in the literature review chapters (Aschbacher et al., 2010; Balster et al., 2010; Barnard, 2019; Chemers et al., 2011; Estrada et al., 2011; Hancock & Walsh, 2016; Hazari et al., 2010; Hemmings, 2012; Hökkä et al., 2012; Laiho et al., 2020; Lamar & Helm, 2017; Mancini et al., 2015; Mantai, 2017, 2019a, 2019b; Marcia, 1966; Marvasi et al., 2019; Mula et al., 2022; Park et al., 2018; Robnett et al., 2018; Settles, 2004; Simon & Mosavel, 2011; Tomlinson & Jackson, 2021) and supported by the results of the previous chapter, a researcher has a specific definable professional identity, and within this identity there are specific roles that are associated with the identity of a researcher. These roles provide a typical set of behavioural patterns of a researcher. In other words, they provide researchers with a blueprint for how to act and behave in a particular situation, with different roles carrying with them specific expectations that are relevant to that specific role, such as behaviours, speech and attitudes. Consequently, it was necessary to explore whether a 'science communicator' was a role associated with being a researcher.

Participants were asked to discuss science communication, with the motivation to understand participants' conceptualisations of science communication and the place that researchers hold within science communication. The chapter begins with participant responses regarding whether science communication was a role that a researcher *should* inhabit. The chapter then proceeds with participants' responses regarding their perceived roles as science communicators and their perceived responsibilities as science communicators. For this thesis, roles can be conceptualised as providing a framework for understanding the general expectations and behaviours associated with the position of being a researcher (Biddle, 1979). Responsibilities will then specify actions and duties that individuals must fulfil to perform their roles effectively. The chapter concludes with an

analysis of participants' responses regarding their motivations for engaging in science communication.

6.1 Is a Science Communication Role Part of a Researcher's Professional Identity?

Participants were asked whether science communication was a role that a researcher should inhabit**.** Most participants stated, 'Yes I think they should be' [INV002], 'I think all researchers should be engaging in communication' [INV017] and 'I think it's central, I mean who else is gonna do it' [INV001]. Specifically, participants agreed that researchers not only have a role, but that this is an active part of being a researcher, 'even if it's just through publishing papers … There's no point in doing science if you don't communicate it. I know some really good scientists who can't write to save their life and who cares … Like if you don't publish it, it doesn't exist' [INV011]. Some went so far as to say, '[science communication is] part of my job description' [INV016]. Another participant stated:

> But ultimately, I'm a very firm believer in researchers taking responsibility for their research, the whole way through the pathway. It shouldn't be that you do a bit of research you [publish a] paper, present it at a conference and move on. It needs to be embedded in some kind of translation process. From the beginning and the end and communication [is] key to that. [INV017]

Interestingly, while there was a consensus that researchers should be engaging in science communication, there were a few caveats to this. For instance, engagement in science communication should not be viewed by researchers as an obligation that they have: 'No scientists should feel the obligation to be a science communicator, it is a very daunting task' [INV016]. Additionally, respondents reported that researchers do not necessarily have to be the main person involved. For instance:

> I think they should be part of the science communication processes, but no, I actually don't think that they should be always the front person out there talking. Because

> often they can be quite naïve, they get trapped into overextending their results. [INV029]

Conversely, while acknowledging the necessity for researchers to engage in science communication, some participants stated they did not think all researchers should be science communicators. For example, ‘less [researchers] should be science communicators not more’ [INV004] and ‘in terms of actually publishing the results, absolutely. In terms of doing public outreach and, you know, interviewing and this stuff, absolutely not’ [INV011]. Another participant stated:

> I think it’s individual dependent, I think that scientists obviously play the most important role in that their [the] knowledge generator. I think that there are some of us that are very good at converting that knowledge into digestible interesting stories that are accessible to lots of different people. I think there are some of us that think that they would like to be able to do that, but don’t necessarily have the skills and capacity [to] do that and should work with social media teams to do that. So yeah, different roles for different people. [INV021]

Some participants discuss this as not necessarily a responsibility that each researcher needs to take on themselves but rather a collective responsibility of science as a whole. For example, ‘all researchers should make sure that their research gets out but not necessarily be the ones to do it’ [INV013]. Another participant noted that:

> I think scientists should be allowed to not talk to journalists, not do any advocacy, just sit down there and do their research. On the other hand, it’s important that some scientists do it. And so, if no scientist ever gave an interview, or did any public outreach, that would be criminal. It’s important for so many reasons. So many things that scientists do affect our daily lives. [For example, with COVID-19 there is a] desperate need for good science outreach. I do think that some scientists have to do it.

> It's important, it's incredibly important. In some ways it's more important than publishing journal articles. But, I don't think any individual has the responsibility. I think scientists as a collective … discipline have to resolve the responsibility. [INV011]

These responses acknowledge the ingrained nature of science communication as being a normative behaviour within the discipline of science and a fundamental role that researchers hold and must play within society. Importantly, though, while participants felt that all science should be communicated, they did not feel that all researchers should be public communicators. This distinction signals a difference in the specific roles researchers should play and their definition of science communication. Given that most participants acknowledge that at least some researchers should be science communicators, this suggests that this social norm (researchers as science communicators) is not discipline-specific but extends to science more broadly. Therefore, these findings suggest that researchers may not view themselves as in-group members based on their discipline but view all researchers as part of one larger in-group.

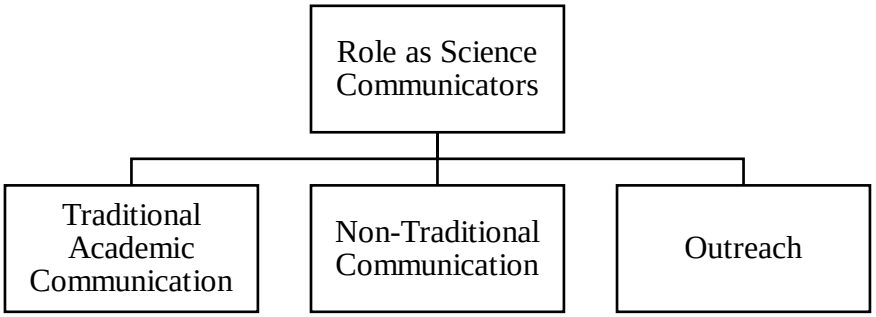
6.2 Researchers' Roles as Science Communicators

Based on the above evidence, there is a clear understanding that science communication is a specific role of a researcher and consequently is part of their identity as a researcher. It is now necessary to explore participants' perceptions of the general expectations and behaviours associated with the position of researcher in this role as a science communicator. Participants stated that researchers have an important role in science communication. For example, 'I think it's important that all scientists have some communications ability… that's the important role that scientists [have]' [INV025]. The significance of researchers' engagement with science communication was underscored by their unique position as the primary agents conducting scientific research, thus best

positioned to communicate the findings. For example, 'They're the people who really understand what has happened. They've been involved in the study, they know the details … if they're not involved … there is a huge chance that it's going to get communicated wrongly or even interpreted wrongly' [INV007]. Participants' responses regarding the role of researchers in science communication can be categorised into three main themes: *traditional academic communication, non-traditional communication,* and *outreach* (Figure 6.1).

Figure 6.1

Participant Conceptualisations of the Role of Researchers as Science



6.2.1 Traditional Academic Communication

Participants recognised the engagement in traditional forms of academic communication as a role researchers undertake as science communicators. Engaging in traditional forms of science communication typically refers to researchers disseminating their research findings and scientific knowledge through established methods such as peer-reviewed publications, conferences, seminars and academic lectures. For example, 'I think the base one is the peer-reviewed publication process… I think it's a very important part of the process because it's part of the scientific method in that it's exposing it [science] to critical review' [INV025]. Another participant stated:

> I think there's a formal role… to get research work published in journals and out in the broader world. I think that's a necessity of science, as part of science, it's what

> scientists are paid to do right. So, I think you could consider it to be part of your job. [INV022]

6.2.2 Non-Traditional Communication

Participants acknowledged non-traditional communication methods as integral to the roles researchers assume in their capacity as science communicators. Participants report engaging in non-traditional forms of science communication as involving the dissemination of scientific information through unconventional or innovative methods that extend beyond traditional academic channels, including engaging with the media and using social media platforms. For example:

> Science communication means talking to normal people… using the media that they use and respect. There's a million different ways to do [science communication], I think you need to tailor it. It could be anything from community meetings, newsletters, to finding a champion… if I need a message to go out to [certain groups] I'll try and get you know [specialist group] to say it. [INV020]

6.2.3 Outreach—Engage with Community, Government and Industry

Participants described outreach forms of science communication as a role that researchers assume in their capacity as science communicators. Participants conceptualised this in terms of actively connecting with and communicating scientific knowledge to diverse external groups beyond academia, including engaging with communities, government agencies and industries. For example, 'Science is… a fundamental tool in decision-making within government and society more generally, and it's about having facts on which to base decisions' [INV025] and 'sometimes you have to be the conduit to getting that out to funding agencies and to the general public as well. So I think they are really important responsibilities for any researcher' [INV014]. Another participant stated:

> I think if you're doing work that is relevant for policymakers, to learn about or that's going to make a change. [It] is useful to inform some sort of decision-making. Just putting it in the scientific literature might not be enough. [INV008]

Some participants go so far as to state that if researchers are not engaging in science communication, then they are not enacting their role as researchers. For example:

> When important information is developed in research, then we do have a role in getting it out there further, if required, if needed… if it does have a purpose in society. A lot of us do research on environmental management and the engagement that we have with the environmental managers is incredibly minimal. And that's very problematic because … you'd think in that particular space, your goal would be to change practise or whatever. But if you have totally no engagement with practitioners then … you're not actually fulfilling the role of researcher in that particular space. [INV021]

6.2.4 Summary

Participants identified three distinct roles researchers fulfil within science communication: traditional academic communication, non-traditional communication and external outreach. These diverse definitions illustrate that some participants view science communication primarily as the dissemination of research through academic journals and conferences, which is an inherent part of their job description. In contrast, other participants consider it in terms of public engagement, which is not explicitly mandated in their job descriptions. These deviations are particularly pronounced in the context of public engagement, where opinions vary on whether all researchers should engage in communication efforts or if it is contingent on individual personality traits, as discussed in the preceding section.

6.3 Researchers' Responsibilities as Science Communicators

Building on from researchers' roles in science communication was participants reported responsibilities within science communication, with one participant stating, 'To me the world is too important, what's happening to it is too important for scientists to… abdicate their responsibility to communicate with the public' [INV001]. These responsibilities are, of course, heavily influenced and shaped by the role expectations of researchers within science communication, as described in the previous section. Three main themes were identified: *honesty*, *objectivity* and *rigour*. Overarchingly, participants highlighted the importance of maintaining the integrity of science in communication by upholding the principles of honesty, objectivity and rigour in the dissemination of scientific information. For example, 'I really believe in honest, open communication and transparency about what we're doing and I don't think there really is a good reason for not being open and transparent about things… it's better to be open and transparent' [INV007]. While honesty and integrity are related concepts, for the purposes of this thesis integrity is operationalised as an individual's adherence to moral and ethical principles, whereas, honesty is defined as truthfulness.

Maintaining the integrity of science in communication is essential for fostering trust and credibility among the public, policymakers and other stakeholders. Accurate and reliable scientific communication underpins informed decision-making, enhances public understanding of science, and prevents the spread of misinformation. For example:

> The scientist has the knowledge, is the authority in science communication. It means something very different to people if doctor Fauci says 'you need to wear masks' or if you say they need to wear masks. Even though you base it on the exact same scientific facts. So, the role of the scientist in communication is to lend credibility to what is actually being said. [INV003]

6.3.1 Honesty

Participants discuss approaching science communication in an honest way and 'tell the truth' [INV010]. Participants further described honesty as a responsibility that researchers have when communicating science. Specifically, participants discussed honesty in terms of communicating science truthfully, emphasising transparency, sincerity, authenticity and integrity. For example, '[As a researcher] you hold a responsibility to be honest, to be ethical, to help empower people in terms of [those] who haven't got that kind of voice [that you do]' [INV014], 'I think it's really important that researchers present factual information… you can't deviate from that' [INV007], 'If they're working in a field and they have knowledge. Their role is to share that knowledge in a factual way. In a way that will dispel any misinformation in the public arena…' [INV008] and 'Stick to the science… obviously we're all biased, it's impossible not to be. But… if you're going to make a statement and an argument, then you need to be able to back it up with science either yours or somebody else's' [INV015]. Another participant stated:

> I think they have a responsibility to not manipulate the audience. So, I think they have [a] responsibility to be aware that audiences often don't actually understand the scientific process and you shouldn't exploit that. [A] responsibility to acknowledge that there are other …alternative perspectives …and perhaps the limitations of what you say. [INV004]

Ensuring transparency when communicating science was described by participants as an important responsibility that researchers have. For example:

> Scientists have to be the ones to communicate science, because scientists are the only ones that really understand it properly. But they have a huge responsibility to understand that a lot of people aren't scientists and so you've got to be able … to

> formulate your communication of science in such a way that [a non-] scientists can understand because if you don't do that, then we're in big trouble. [INV032]

Furthermore, researchers discuss honesty in terms of a responsibility to 'give appropriate credit to those who have done the work, particularly in collaborations and particularly with students as well and not claiming works that isn't ours' [INV006]. Some participants describe using honesty as a way to correct misinformation:

> We need to call issues to account. If we are pretty clear that we have evidence that science refute[s] it or the data refutes it, I think we all have the responsibility to try [to] communicate to people that want to hear how things work and [provide an] explanation for things formally. [INV032]

Another participant noted that:

> I think trying to stay out of advocacy, but to correct misunderstanding. And so, if there's a situation where something blows up in a public or political way. I think the role of the scientists is to simply say '[there was a] misperception or the presentation of this … part of which I'm an acknowledged expert… is incorrect. [INV023]

Ensuring transparency in communication is an important responsibility for researchers within science communication. Specifically, researchers should be transparent with the public about the limitations of science, the scientific process and their own inherent biases in the research in which they do. This is illustrated in the following quotation:

> I think they [researchers] have an obligation to accurately represent their research findings, especially if it's an important thing. [Some sciences] do need to sort of introduce the doubt and make sure that people understand that science isn't the truth… there is always doubt… For me, my research is political by design… I ask questions that I ask for a reason… I guess I have an obligation to talk about that… and to take a position… I do think that we [researchers] have an obligation to try and

> understand things and to introduce nuance, but I think taking a position doesn't make you a bad researcher. [INV013]

6.3.2 Objectivity

Participants described objectivity as a responsibility that researchers have when communicating science. Specifically, participants discussed objectivity in terms of evidence-based communication that emphasised their impartiality and focused on minimising the influence of their own personal biases or preferences. For example, 'We are evidence-based practitioners right and no matter what comes out of our mouths or what we write down on a piece of paper that evidence has to be… transparent and reproducible' [INV032], 'Our job is to provide independent transparent information for the rest of society to use' [INV028], 'To present… factual information about the study findings… you can't deviate from that' [INV007] and 'Communicate evidence-based information as opposed to personal views and ideologies' [INV015]. Another participant noted:

> For me science is about providing facts and evidence to make informed decisions … So, for me the scientist's role is to provide those facts… They can provide some interpretation of what that is, and what it means and the implications and potential outcomes, but it is not a scientist's role to tell anyone what to do. [INV031]

Not only is evidence-based communication part of a researcher's described role in science communication, but so is being a fact checker. For example:

> I think scientists… have a major role to be the fact checkers… All this nonsense that's going on at the moment, it is absolutely mind blowing, what alternative facts and things that are out there… so how do you deal with [people who don't trust science]? I mean, you only deal with it with facts; you only deal with it with science, right? And you can in a cool, calm way, present the evidence and that's what I think scientists probably really need to do…. You've got to counter their arguments with truth as

> science has determined it to be, right, not absolute truth but [what] science has determined it to be. So, I see a major role in science communication. It's not just getting out there and presenting facts right, because they can get drowned out by all of the alternate facts. Although that is important, but fact checking, definitely showing people the importance of the scientific method and evidence [is important]. [INV03]

6.3.3 Rigour

Participants articulated that researchers are responsible for maintaining rigour in their science communication efforts. Participants conceptualised this responsibility as encompassing the accurate presentation of facts and data without exaggeration. Additionally, it was emphasised that researchers must ensure their communication falls within their area of expertise to uphold the integrity and reliability of the information disseminated. For example, 'In my experience I wouldn't be going in commenting or promoting things that are not in my interest or not in my area of expertise' [INV022]. Another participant stated:

> I think that you should know where your expertise lies and be willing, able and comfortable to not speak outside that. So, you don't talk in someone else's area of expertise. And just because you're a scientist in one area, doesn't mean to say that you're a scientist in all areas. I think that we have a responsibility to make sure that we don't talk out of turn. [INV006]

6.3.4 Summary

Participants described the responsibilities incumbent upon researchers when engaging in science communication, outlining the overarching expectations and behaviours associated with their role as science communicators. These responsibilities encompass honesty, objectivity and rigour in their communication practices. Collectively, these aspects underscore the imperative for researchers to uphold the integrity of science, ensuring that their communications are accurate, unbiased and methodically thorough.

6.4 Motivation to Communicate

Respondents discussed several motivations for engaging in science communication. Participants described feeling compelled by a drive to communicate science and apply their expertise for the benefit of society. Consequently, participants described being motivated by a desire to influence policy and contribute to evidence-based policymaking, ensuring that their research informs the decisions that affect society. This motivation resulted from participants recognising the importance of making scientific knowledge accessible and understandable, thereby fostering informed decision-making in society. Additionally, participants highlighted that engaging in science communication may be necessitated by their employers. Two main themes emerged from participant responses: *societal impacts* and *professional obligations.*

6.4.1 Societal Impact

Participants described being motivated to engage in science communication owing to the importance or relevance of the research they were communicating. Specifically, participants were signifying their intention to convey scientific knowledge that addresses significant societal challenges or interests. For example, ‘If you’re undertaking research that is really important and has implications to industry or the public, there needs to be some ways of getting that across to people’ [INV002] and ‘I generate evidence that supports policymakers to make evidence informed regulation to improve health’ [INV012].

This communication often focuses on research findings that have practical implications, such as advancements in healthcare, environmental sustainability, technological innovation or social policy. For example:

> So, you might do a research project with an industry partner, you write a report with that industry partner, but you might also have an agreement that you go to publish that as a publication. But that might actually be really important to inform policy. So, then you write policy briefs that you give to government. So, you end up having these

> different layers of communication depending on who is reading it, and why they need it, and what they are going to do with it. [INV002]

Participant responses highlighted a desire to bridge the gap between scientific knowledge and public understanding by highlighting how their research can contribute to addressing real-world issues, informing public discourse and potentially influencing decision-making processes. For example:

> My research is social science research. [It] involves people from all around the realms, and basically, it's about me being in touch with the social problems out there. Asking the right questions. Getting it [the research] out to people. Then perhaps taking it up at some point and having some sort of positive impact on their lives, in terms of policies or change the rules, [or] change the laws. Which might affect people in a positive way, which might not have occurred unless I've done the research [and communicated it]. [INV014]

This motivation reflects researchers' commitment to ensuring that their work benefits society at large, beyond academic circles, by promoting informed discussions and fostering evidence-based decision-making. For example, 'depends on the need in the community. Is that something that's a community priority? Is that something that's a community burden?' [INV017], and 'it completely depends on your audience and on your intent in my opinion' [INV020]. Another participant noted:

> It really depends on the research that they're doing. If I think about impact… everyone should be communicating in the appropriate way to ensure that their science reaches the correct audience, in the appropriate format to have the impact that they're trying to achieve. [INV015]

Another participant noted:

> Particularly with the social sciences … helping [give a] voice to the under-served and vulnerable. Helping their voices be heard as well. So, for me science can also, not that we want to speak for them, but to support them having a voice and getting to the table and so that's the other part of what I see science can do. [INV026]

6.4.2 Professional Obligations

Participants stated that their motivation to engage in science communication was driven by professional requirements and expectations within their respective fields. This motivation often stems from institutional mandates or funding agency requirements that prioritise the dissemination of research outcomes to broader audiences. For instance, researchers may communicate their findings to fulfil reporting obligations to their employers or funding agencies, demonstrating accountability for the resources invested in their research. For example, 'We are financed by taxes, it is our obligation to ensure that information is used in the best way possible' [INV031] 'I think we all have a responsibility to be communicating what we do particularly if its funded' [INV029] and '[I engage in science communication] only when I'm required to for contractual reasons. I don't do anything above and beyond that' [INV004]. Another participant stated:

> I think that [science communication] is a responsibility, that a large amount of money that we actually get is from either Federal or State Government. And therefore there is a responsibility to society to actually, translate some of the technical terms and information into something that's digestible to cause genuine change. And if we don't do that, we're our own worst enemies because the public is not aware [of] what we do. It makes us vulnerable in terms of progress and makes us vulnerable in terms of people understanding the role of science. And at the end of the day, what are we there for if it's not progressing the opportunities to society to have sustainable practices or have progress and technology. [INV018]

Additionally, disciplinary norms may encourage or mandate researchers to engage in communication efforts to uphold standards of transparency, public accountability and the promotion of scientific knowledge within their academic or professional communities. For example, ‘It depends on the research doesn’t it’ [INV002], ‘So it is internalised as part of the process. So, it’s going to be heavily dependent on the type of research and the end goals of that research’ [INV019], ‘Depends on the field’ [INV025] and ‘Social sciences were different in terms of the discipline, because it takes us a long time to churn out a qualitative research study’ [INV014]. Another participant stated:

> It depends partly on your employer. If you’re employed by say the government and you’re in let’s, call it a free Western country, where presumably the taxpayer knows what they’re getting for their buck. Then I suppose there’s some sort of ethical responsibility there to try and communicate that information as broadly as possible and as frequently as possible. If you work in the private sector, some employers would… I definitely have colleagues who are encouraged not to communicate anything because of privacy and patent reasons—trying to make money. So, they don’t necessarily want all their trade secrets in the public domain and so I think it really depends on your employer and your employment situation. [INV028]

6.4.3 Summary

Participants acknowledge that researchers are motivated by a sense of societal impact and professional obligation when engaging in science communication. Participants who are driven to communicate based on the importance and relevance of their research for society suggest a strong altruistic drive underpinning their motivation to engage in science communication. This altruistic drive is suggestive of a recognition of the crucial role that effective communication plays in fostering public understanding and informed decision-making, thereby contributing to societal progress and wellbeing. By disseminating their

findings, researchers were describing an aim to bridge the gap between complex scientific knowledge and public understanding thereby potentially addressing misinformation and enhancing scientific literacy. This endeavour is not merely altruistic but speaks to a shift in the norms associated with science, which proposes that research has practical applications and benefits for society—once again demonstrating a movement away from pure science. Furthermore, professional obligations underscore the role of external pressures and professional standards in motivating researchers to communicate their work beyond academic settings. Cognitive dissonance for the researcher may then arise as a consequence if these external pressures are at odds with the individual researchers' conceptualisations of their roles and responsibilities in science communication.

6.5 Conclusion

Participants emphasised that researchers play a multifaceted role in science communication, encompassing activities such as publishing academic papers, presenting at conferences and engaging with various stakeholders, including community groups, government officials, media and industry representatives. Central to this role is the responsibility to uphold the integrity of scientific information through practices of honesty, objectivity and rigour. Motivations for researchers to engage in communication include the societal relevance and impact of their research and professional obligations related to employment, funding requirements or contractual commitments. Despite the belief that all science should be communicated, participants did not believe that all researchers should be public communicators. These differences stem from divergent interpretations of their role, differing definitions of science communication, and varying perceptions of their responsibilities based on these interpretations. This variability underscores the complexity and diverse perspectives within the scientific community regarding the extent and nature of researchers' communication roles and obligations.

Chapter 7: Advocacy Communication Responses

As reported in the previous chapters, researchers have a distinct professional identity with an associated role in science communication. This role as a science communicator was associated with a behavioural blueprint for how researchers should act and behave when embodying their professional identities as researchers. According to participants, the role of researchers in science communication encompasses the dissemination of academic papers, participation in academic conferences and interaction with diverse stakeholders, including community groups, governmental bodies, the media and industry representatives. Within this framework, researchers are entrusted with safeguarding the integrity of scientific endeavours through the principles of honesty, objectivity and rigorous methodology. Motivation for communication arises from the perceived societal relevance and impact of their research and their professional obligations pertaining to employment, funding and contractual commitments. Importantly, researchers unanimously recognise the imperative for science to be communicated, yet their views diverge regarding the universal suitability of researchers as public communicators. This discrepancy manifests through varying interpretations of their professional role, definitions of science communication and corresponding responsibilities aligned with their individual role interpretations.

As discussed in Chapter 1, although a predominant focus on science communication in its traditional form remains, such as communication among researchers through scholarly journals, there is a discernible trend towards diversification, encompassing advocacy and stealth issue advocacy as alternative modes of dissemination (Dodd, 2018; Pielke, 2007). Indeed, to optimise societal benefits derived from scientific advancements, science communication is increasingly embedded within advocacy frameworks, with research suggesting that researchers are progressively assuming advocacy roles (Côté & Darling, 2018). Consequently, to address the aim of this thesis, it is necessary to investigate

participant perspectives regarding advocacy in science communication. In support of this, some participants self-identified as advocates during the interviews. For example, 'If I think back to my own advocacy work' [INV027], and another participant stated, 'I think I'm first and foremost an advocate … I see research as an essential component … as well as a tool to be able to do that more effectively' [INV007]. Participants were asked questions to explore their views concerning advocacy further, encompassing their beliefs on researchers' involvement in advocacy, as well as the roles and responsibilities of researchers' engagement in advocacy. Accordingly, this chapter details participant responses.

7.1 Is Advocacy Encompassed Within a Researcher's Professional Identity?

Contrasting with the findings discussed in the preceding chapter, which indicated widespread agreement among participants regarding the importance of researchers engaging in science communication, opinions diverged regarding researchers acting as advocates. Responses ranged from verifications of the necessity for researcher engagement in advocacy, outright objections to researcher advocacy roles, and mixed opinions on the topic.

7.1.1 Verification

Several participants confirmed that advocacy was a role that researchers should inhabit. For example, 'I think it's again essential' [INV002], 'I don't think there's anything wrong with it' [INV015] and 'I see myself first, as a scientist… a scientist who… is willing to advocate on behalf of what I'm passionate about' [INV016]. By confirming advocacy as a role that researchers should inhabit, participants confirmed that advocacy engagement by researchers was a part of their professional identity. Furthermore, respondents stated that their discipline might endorse advocacy by researchers; for instance, 'In public health … health policy and systems research, advocacy is generally viewed [in a] very positive way' [INV019].

Participants described the general expectation of researchers' role within advocacy as facilitating the dissemination of information, making the sharing or communicating to wider audiences easier. For example, 'I think we have a real role in actually making the public aware of positive and negative issues or… things to do with particular issues' [INV018]. Acting as a facilitator was also conceptualised in terms of removing barriers, providing resources or taking actions that promote the flow of information from its source to intended recipients. For example, 'it comes back to that facilitator… we would like science to influence opinion… but not direct [that] and that's the difference for me from my perspective' [INV031]. Another participant stated:

> So, the role I see other than my own research work interests is … I see it as the marriage broker. Some of the advocacy work I have done… is really that marriage broker between the [practitioners] and the scientists. Because often they can't speak that language… but being in the middle, and being able to legitimately be accepted by both sides is a unique role and the role that I suppose I've carved out as my applied research. [INV026]

Another participant noted that:

> There's lots of different ways to… get involved in these things but that's really dependent on [the] specific situation… Our conservation work would be focused on whoever and whatever entity we think is most important for advancing that. But often it'll be a number of different [groups] the NGO community, science community, the general public, decision-makers and really, we would often be trying really broadly to influence all of those where possible. [INV001]

7.1.2 Objection

Conversely, some participants responded in other ways: 'No, I really don't [think researchers should be advocates' [INV024], **'**Yeah nah shouldn't be doing it' [INV004], 'I

don't think that every scientist has to be an advocate' [INV016] and 'I think it's really important to be clear and not to advocate… It doesn't mean you can't comment… You just have to frame your comments in terms of your expertise' [INV007]. While other participants stated that not all researchers should advocate because it is not a researcher's role. For example, 'We're under a lot of pressure to advocate … we're told you should advocate … but… I don't think that that's our role and that's why I said I don't think everyone should do it' [INV024]. Another participant noted:

> I don't think they [researchers] should be [advocates]. I think it's a personal thing. I know lots of scientists who will not go anywhere near… advocacy of [their] science, unless they are asked a particular question about the topic of interest. [Then] it's up to them how to respond… there's probably lots… might even be the majority of scientists, don't actually go… near advocacy. [INV022]

7.1.3 Advocacy as a Peripheral Role

While many participants acknowledged the value of researchers engaging in advocacy, some conceptualised it as an optional rather than obligatory role. Specifically, they viewed advocacy as extending beyond their core professional responsibilities and as distinct from the act of science communication, positioning it as an additional role that lies outside the scope of their typical roles. For example, 'But certainly they have a role, but again, none of it's an obligation in science. It is something that we do above and beyond' [INV015]. Furthermore, some participants emphasise that not all researchers possess the requisite skills for effective advocacy, suggesting that researchers lacking such proficiency may be ill-suited for engaging in advocacy. For example, 'I think it's great. I don't think everyone's great at it, just like with science communication. I think… if you can combine research with advocacy, it can be really, really effective' [INV019] and 'the problem here is whether all scientists should be advocates… not everybody is actually a good communicator publicly… trying to

fit everybody into that category is very dangerous' [INV029]. Furthermore, some participants described engagement in advocacy as being a personal choice; for example, 'It's important for scientists not to be advocates unless that's what [they are] choosing to do, you can't do both in the same space' [INV025].

Furthermore, participants reported this additional role of researchers within science advocacy as being more context-dependent. Participants conceptualised this as their choice to engage in advocacy, which was influenced or determined by the environment, such as who researchers were communicating with. For example, '[When advocating] I think you use different language… when you say advocating to the public is that advocating to change behaviour or perhaps you [are] using your research findings to advocate [for] a certain direction' [INV002]. This was further conceptualised to include how far researchers should go in promoting their science. For example, 'Advocating is basically around getting people on side, taking on the ideas that you've got. Having lots of conversations [and] not pushing it too far in terms of being too pushy' [INV014]. One participant specifically described the conflicting nature:

> It's not my role to tell people … how to do their jobs… [I interpret my outcomes to say] what can we learn from this, what can we do with it…I will say this is what happened, this is what we can learn from it. But it's not for me to say [what governments or councils do with that information]. [INV031]

7.1.4 Summary

Participant opinions diverged significantly on whether advocacy constituted a fundamental aspect of a researcher's professional identity. Responses varied widely, ranging from statements of the necessity for researchers to engage in advocacy, distinctions drawn between advocacy and science communication, outright objections to advocacy roles, to mixed perspectives on the topic. These divergences may stem from the absence of a clear

consensus on the definition of science advocacy and its role within the scientific community. It is conceivable that because advocacy involves communication, being integral to researchers' identities, researchers may identify advocacy as part of their professional role, thereby contributing to ongoing uncertainty regarding definitions and roles in this space.

This variance in responses may also reflect disciplinary-specific social norms associated with advocacy. For instance, health researchers appear more inclined to advocate based on their research findings, possibly owing to the direct relevance of their results to immediate public health concerns. In contrast, environmental researchers may display increased hesitancy, given the more distal nature of environmental threats and potential public backlash. Thus, disciplinary-specific contexts may influence researchers' confidence and willingness to engage in advocacy, illustrating the nuanced dynamics shaping field-specific attitudes toward advocacy roles.

7.2 Researchers' Responsibilities as Advocates

Given the recognition that advocacy is, at least in part, associated with a researcher's identity, it becomes essential to understand the corresponding responsibilities a researcher has when engaging in advocacy-based communication. Specifically, it is necessary to understand participants' perceptions of the general expectations and behaviours associated with a researcher's position as an advocate. Overarchingly, participants described maintaining the integrity of science as the main responsibility of researchers when advocating. Notably, this emphasis on integrity indicates significant parallels between the responsibilities of researchers in science communication and those in advocacy. Specifically, participants highlighted the importance of maintaining the integrity of science when engaging in advocacy, which involved navigating a complex terrain where researchers must uphold rigorous scientific standards while advocating for evidence-based policies and public awareness. For example, 'We really only want to speak by some evidence … credibility

comes from speaking on the evidence' [INV012]. Other participants stated: 'I ensure that … I'm always presenting robust research findings and communicating in a clear way so that things can't be taken out of context… if people were to challenge my advocacy messages I can back them up' [INV007] and 'I'm of the view that… it's really incumbent upon us in our responsibility to be fair operators in doing what we do' [INV001]. The same participant went on to say:

> You're seeing a lot of people [scientists] particularly in the realm of climate change … really strongly advocating and I think that's okay. But I just think we have to be careful … we aren't misrepresenting the data in some way, or something like that. [INV001]

Additionally, participants emphasised the importance of objectivity and honesty, particularly in ensuring that their advocacy is firmly grounded in scientific evidence. This indicates that participants strive to uphold the standards of the scientific method, specifically objectivity, by performing their roles in a manner that preserves the integrity of science. For example:

> [What] defines us as scientists is that we are evidence-based practitioners, right. No matter what comes out of our mouths, or what we write down on a piece of paper that evidence has to be able to be transparent and reproducible. If we come to advocacy without that, then we're just being like my neighbour who just says Fox News says [the lunar module] didn't land on the moon. [That incorrect information] it becomes truth. [INV032]

Another participant stated:

> I think as long as they always stick to the facts, and not try and twist them, or twist scientific findings, or just pick and choose the bits that they want that support whatever position they've taken… then I think that's really important as well. I have

> seen some cases where people will just take a little snippet of something that fits their argument and ignore the rest of it which might not necessarily support their arguments. So, I think they need to stay true to science and respectful. [INV008].

Furthermore, participants discussed ensuring that any potential conflicts of interest are communicated clearly, which again speaks to the importance of maintaining the credibility of science through advocacy. For example:

> So, I think if you're positioned in a way that you can gain personally from a product, from a particular decision going one way or another… Well number one, you're not going to be the objective voice here. And number two, I think the audience needs to… make up their own mind about that. [INV027]

Another participant stated:

> I think science does have a very important role to play in advocacy. But I think it's a fraught business because it comes back to the trust and… the motivation and the [potential] suspicion of conflict of interest. If you're seen to be in any way having a vested interest in this issue that you could benefit from it individually. I think that's a turn off. I think that doesn't pass the sniff test to many members of the public. I'm certainly very wary of it myself. If I'm seeing somebody really bang the drum about an issue, it's like 'yeah well you would say that wouldn't you, you're from the tobacco industry or whatever it is'. So, I'm very careful about that. But no, I'm a fierce advocate for particular issues. One where I think my voice helps, and is a trusted source of information and I think it can make a difference. By doing this I appreciate the risks, I've worn some of those risks, and I'm up for it. [INV027]

Furthermore, participants describe the importance of ensuring that their advocacy remains grounded in robust empirical evidence, transparently communicating uncertainties and limitations inherent in their research findings. For example:

> I think that when scientists do it [advocacy]. And it's factually based. And they continue to make sure everything that they say and do has a basis in science, it is much more respected than just someone who has a strong opinion on something. So, I do think it carries more weight when it's coming from a respected scientist. [INV008]

By adhering to these principles, researchers uphold the credibility of scientific information disseminated during advocacy, fostering trust among stakeholders and the public. For example, '[Advocacy] it's extremely important because it provides that public face, the credibility to the university, it critically influences how people outside the university talk about the university' [INV003]. Another participant highlighted:

> I think when scientists advocate publicly it's very powerful. I'll always put the caveat out there that with power, comes great responsibility. Scientists [are] in general trusted voices because you're a recognised expert. Therefore, what you say, well most people, is treated as gospel… I'll speak in the positive sense because I feel like the negative is pretty obvious. So, in the positive sense, it's very powerful because, [and] this is no disrespect to other advocates who aren't scientists, but just gives you that little bit extra credibility. You just have that extra credit as a scientist because I think the general frame is you're a scientist, you're an expert. [INV016]

While maintaining the integrity of science was the overarching responsibility of researchers within advocacy, there were two distinct themes that differentiated advocacy-related responsibilities from those responsibilities in science communication: *considered and respectful engagement* and *maintaining ethical engagement and personal integrity*.

7.2.1 Considered and Respectful Engagement

Differentiation between advocacy and science communication role responsibilities can be seen when participants expressed the need for a considered and respectful engagement approach to advocacy. For participants, this meant maintaining policy neutrality by refraining

from exacerbating political tensions or controversies. By maintaining neutrality, the researcher would thereby avoid actions that could inflame contentious issues unnecessarily. For example, 'being aware that… your voice may create the impression that an issue is bigger than it might be… just understanding the privilege… as a scientist in particular contexts' [INV004], with another participant stating:

> I think there is a line, I think it's probably context-dependent. We live in a world in which it's not just what's being said, it is who's saying it. So, for instance, a message that might be completely acceptable for an African American woman or for an Indigenous American person, would be completely unacceptable for somebody else. So, who says it is really important. [INV001]

Furthermore, being considered and respectful in advocacy was conceptualised as making realistic recommendations. For example, 'You have to be really clear about the fact that something [is a] benefit for society and why that is, by taking stock of the broader, social, economic and political environment' [INV007]. Another participant noted that:

> I personally really struggle with scientists, getting up and saying 'we have to stop coal mining tomorrow, because it's ruining the planet'. You can't just stop that overnight. So, you have to have a more graded response. It needs to have sensible answers, as opposed to highly emotive and unrealistic solutions. You need a broad knowledge, and you also need to be very aware of the pressures on society in terms of employment, how the country is tracking, what their market is like, what the reality is of change… So socio-economic and biological considerations have to come into those debates. [INV018]

Another participant observed:

> You've got to sort of understand the context. There's economic imperatives that we've got to keep [in mind] that Government [has] got competing priorities. So,

> you've got to be able to temper your advocacy around, and you've got to be able to get inside the tent. [INV017]

Lastly, participants conceptualised a considered and respectful engagement in advocacy by including diverse perspectives and communicating clearly and respectfully. For instance, 'What's not acceptable is saying or doing something that causes offence personally to someone else' [INV006], 'being rude and obnoxious I think that's the cut off for me when I see people doing that it is like that's just inappropriate' [INV022] and 'as long as… your respectful about it like you obviously can't always sugar-coat everything of course but as long as you're respectful about the message that's out there' [INV030]. Another participant noted:

> By putting your ego aside and actually being open to engaging in the discourse and advocacy, but in a respectful and open manner. I think if you're not willing to engage in the conversation with people who are going to be your detractor's, maybe you don't choose to advocate at that time. [INV020]

7.2.2 Maintaining Ethical Engagement & Personal Integrity

Participants discussed maintaining ethical engagement and personal integrity when engaging in advocacy as a fundamental responsibility for researchers. For example, 'I think it's a careful line…I really do, I think we have to back ourselves as scientists. If you don't then you shouldn't be here definitely but [advocacy] is a fine line' [INV033], and 'You have to be careful about whether that [is] self-promotion or whether it's advocacy or whether it's doing it for the university' [INV026]. Furthermore, the discussion on ethical engagement emphasised the importance of ensuring researchers communicate within their expertise. For example, 'I think… [researchers should] stick within their area of expertise. They should be really careful about the message that they're putting out and they should definitely not fall over, into black and white positions that are not supported by evidence' [INV024] and 'As

long as you're speaking within your area of expertise and you're being reasonable… then you should be able to speak publicly and without fear or favour' [INV001]. This was further expanded upon by other participants who stated:

> I think, you have to be careful that you're advocating around things for which you actually have a good solid knowledge base, and that [you] have got an evidence base behind them. I think it's dangerous when you start getting people sort of going off into uncharted waters. [INV017]

Another participant noted that:

> I guess I try and ensure that I'm always presenting really robust research findings, and communicating in a clear way, so that things can't be taken out of context. And you know, if people were to challenge my advocacy messages I can back them up. [INV007]

Participants also described maintaining the robustness of scientific evidence as vital during engagement in advocacy efforts. For example:

> I'm wary of [advocacy] because I think the implication of doing that to some people, is that you put your advocacy priorities above your research. I think I'm a researcher and an advocate. I make sure that I do robust research to inform advocacy. And I do research about advocacy. But fundamentally my mission is to try and make a difference and to improve society. That's my priority, and I think research and advocacy are tools to do that. [INV007]

Furthermore, ethical engagement was discussed in terms of staying non-political and using advocacy as an educational tool to enhance public and policymakers' understanding of scientific issues. For example:

> We all have our opinions; we all have our worldviews. I think if you are going to get involved in the public discourse and advocacy you need to be very aware and mindful

> of your own position and worldviews… I think you also need to be receptive and curious about other people's worldviews. [INV020]

Lastly, participants described researchers having a responsibility to correct misinformation within advocacy. For example, 'We have to be careful to monitor… and provide reliable and trustworthy alternative voices when you know something not to be true' [INV009], with the same participant going on to say, 'When as a scientist, you see that something is wrong and you have evidence that backs up that opinion you need to be sharing it' [INV009]. Another participant said:

> I think they should simply be conveyors of the information. Occasionally they should seek to correct misunderstanding. But I think it's important to just say, I did this experiment and... these are the results. Where I'm torn with where it can inform the situation, but I think if, especially [in] a situation if there are polarised views on the topic. And it becomes a matter of media interest or political interest. I think it's a really dangerous thing for scientists to get into the advocacy sphere. [INV023]

7.2.3 Summary

Participants described researchers' responsibilities when participating in advocacy communication, outlining overarching expectations and behaviours linked to their role as advocates. These responsibilities were, at times, similar role expectations to those conceptualised within science communication. However, distinct advocacy role responsibilities were identified, including engaging in considered and respectful advocacy and maintaining ethical engagement and personal integrity. These aspects collectively emphasise the imperative for researchers to maintain the integrity of science while engaging in advocacy communication.

7.3 Motivation to Engage in Advocacy

In discussions on advocacy by researchers, participants underscored the motivations that compelled them to engage in advocacy efforts. Participants described feeling compelled by a commitment to apply their expertise for societal benefit. This drive was described as stemming from a sense of responsibility to ensure accurate dissemination of scientific knowledge to policymakers. It also reflects personal values, such as addressing societal challenges, while seeking to influence policies and garner support for research that can contribute positively to society. Two main themes emerged with corresponding sub-themes: *power* (*funding* and *influencing policy*) and *choice* (*discipline norms* and *personality*).

7.3.1 Power

Power was identified as a significant motivator for researchers engaging in advocacy. It was conceptualised in terms of the influence that securing additional funding exerts over career advancement and research progression. Additionally, power was discussed in the context of the political influence that researchers can wield through their advocacy efforts.

7.3.1.1 Funding. Funding emerged as a prominent sub-theme in discussions related to power. Specifically, participants described that their primary drive is to obtain financial resources for their research. For example:

> If you're trying to save the reef, you've got to get the attention of key people in government, you've got to get the key people who are funding the funding bodies. You have to have the art of writing to the right people, and applying for the right grants, getting the right team. [INV014]

Interestingly, the drive to engage in advocacy for securing funding was discussed as an essential component of the funding cycle. For example:

> So, the whole role of people, in advocacy role[s] is important. But I think scientists can't sit back and complain that nobody funds us, or sees the importance of us, if

> you're not partly engaged in a way you feel comfortable with [in] getting your messages out or showing the importance of it. [INV026]

However, this was sometimes discussed as a conflict of motivation, where the researchers have the power to influence funding directions. For instance:

> Right now, we're in a position where the competition for funding is extremely strong. And so, if you work on a threatened species you're more likely to get money than if you don't. And so, there's strong advocacy to get species on threatened species lists. Now I don't think that there's anything on the threatened species list that doesn't belong there… Some of the animals that we were working on, that we found out were no longer dying of this disease. The disease had become endemic in [the] population and were no longer dying. Then they went off the threatened species list—which is good, I'm happy about that. But we didn't get funding anymore and so, you know, once I sort of thought to myself 'hmm maybe that was a dumb move'. But… I can move onto something else but… I can see why people would go 'no, no, no they are still threatened don't you dare take them off that list'. Especially now 'cause there really is only money for threatened species. There's no money for anything else. It's very difficult to get any funding. [INV024]

7.3.1.2 Influencing Policy. Influencing policy emerged as a sub-theme discussed in relation to power, with participants describing that one of the motivations for engaging in advocacy involves emphasising the impact and importance of their work. For example, 'I think advocacy comes into its own where you have a policy, public policy agenda' [INV019], with another participant stating:

> I think [advocacy is] a really important part of research. I think all researchers have got… a responsibility for trying to ensure their research is heard by, and acted on by

> the [right] people… and the people that are gonna make sure it makes a difference. [INV007]

Importantly, the drive to influence policy can influence the type of science that participants engage in, aligning their research goals with policy priorities and effectively removing the drive and incentive to engage in pure science. For example:

> I would say that it even [advocacy] comes back to how I designed my research. I know what's happening on a policy issue and I only do research that's deliberately going to… give an outcome that's relevant to a policy issue. [INV012]

7.3.2 Choice

Participants described motivation driven by choice when engaging in advocacy. This motivation was reportedly driven by disciplinary norms or their own personality. It implies a deliberate and conscious decision to use their scientific expertise and platform to promote specific outcomes or changes they believe in.

7.3.2.1 Discipline Norms. When participants described their motivation as being driven by disciplinary norms in advocacy, they described the influence of the established standards, ethics and practices within their scientific discipline. For example, 'I don't think all scientists should be advocates but I most definitely think there is a place for some scientists who choose to, depending on them, depending on their discipline, to be advocates' [INV027]. This motivation underscores a commitment to professional standards and the responsible dissemination of scientific knowledge to inform policy and public understanding effectively. For example, 'Some of the arts disciplines… they see social justice as a fundamental part of their approach methodology… the rules of their discipline say that is okay and some call that advocacy and some not' [INV004].

Interestingly, in some disciplines, not engaging in advocacy was considered ‘abnormal and noticeable’ [INV013]. The choice to engage in advocacy may also be dependent on the specific results obtained, as one participant discusses:

> I’m thinking about a colleague who is doing qualitative research with a particular population group, and her findings are showing that this group is quite disadvantaged in many ways. And it’s a governance issue. And it could be addressed through much better and improved governance. And so, she almost has an obligation … to make sure that’s reported back to the right people, so that she can advocate for changes in their conditions. That’s really important... You know sometimes there’s an obligation there to do something with that information you’ve gathered but not always. I mean if you’re doing really pure science that might not be the case. [INV002]

This suggests that engaging in advocacy may not always be perceived as a voluntary choice but rather as an obligation to convey significant findings. This interpretation is corroborated by insights from Chapter 5, which explored researchers’ professional identities and highlights their motivation to enter and persist in the field of science as being driven by a desire to effect societal change. However, as discussed in Chapter 6 and earlier in this chapter, there is considerable ambiguity amongst participants regarding whether science communication should inherently include advocacy. This ambiguity underscores potential role conflicts researchers may encounter. For instance, if their professional identity is driven simultaneously by a commitment to societal impact and a reluctance to engage in advocacy, the obligation to communicate scientific findings may create internal conflict within the researchers.

7.3.2.2 Personality. Participants described being motivated by their individual personality in advocacy, specifically their personal values, passion for societal impact, communication style and willingness to take risks. For example, ‘I think it’s a personal

thing… I know lots of scientists who will not go anywhere near advocacy… unless they're asked a particular question… and then you know it's up to them to how to respond' [INV022]. Another participant stated:

> I think a lot of scientists aren't traditionally very vocal. They more like to get in and get on with science. They're not necessarily the people… getting up in front of crowds and giving opinions. They like to deal with facts… I guess… it's up to them [individually] to make that decision and everybody's different. [INV008]

Participants described motivations to advocate for causes that aligned with their beliefs, striving to make a positive difference, using their unique communication skills effectively and challenging conventions when necessary, as one participant described:

> It really is again horses for courses, and it depends on your personality. It can also depend on… what organisations or movements you align yourself with. Some people prefer to be more in your face and aggressive and upfront and they have every right to do so. Some people prefer to be a bit more subdued, work through laws and do it that way. They still have the equal amount of action, just going about it in a different way… so long as it's legal, then you have your democratic right to voice your point of view. [INV016]

7.3.3 Summary

These motivators underscore the intricate dynamics involved in researchers' engagement in advocacy. Beyond grappling with their own inclinations and perceptions of their role within society as researchers, they are also positively and negatively influenced by discipline-specific considerations. This complexity may not be uniformly challenging for all researchers because professional identities and roles are shaped within each discipline during their formative and active years. Consequently, for many researchers, their ideologies around their place within advocacy may align closely with their disciplinary norms, alleviating any

risk of conflict. However, there is a growing emphasis on interdisciplinary collaboration and engagement; these divergent perspectives may clash, creating internal and external pressures and challenges for researchers.

7.4 Conclusion

This chapter provides a comprehensive analysis of participants' conceptualisations of advocacy, focusing on their perceived roles, responsibilities and motivations. Participants expressed a wide range of views on advocacy, some of which appeared contradictory or incompatible. According to participants, the extent of researchers' involvement in advocacy ranged from no direct engagement to acting as facilitators of information dissemination, with the level of engagement varying depending on the specific context. Similar to responses towards science communication, participants underscored the importance of maintaining scientific integrity in advocacy through adherence to objectivity, honesty and rigour. However, participants also clearly distinguished the responsibilities of advocacy from those associated with science communication. In particular, they emphasised the necessity for thoughtful and respectful engagement and the maintenance of ethical standards and personal integrity when participating in advocacy efforts. This differentiation was further evident in participants' discussions of their motivations for engaging in advocacy, which often centred on power considerations, such as the pursuit of increased funding or influence over policy, in addition to personal and disciplinary norms. This chapter highlights the intricate interplay between researchers' roles, motivations and the ethical dimensions inherent in advocacy, stressing the complex nature of researchers' involvement in public communication and policy advocacy within both academic and professional settings. Moreover, it suggests that navigating potential conflicts of interest and balancing advocacy with core scientific responsibilities are critical challenges researchers must address to ensure their advocacy efforts remain constructive and aligned with professional norms.

Chapter 8: Factors Influencing Modes of Engagement

Chapter 5 provided a detailed examination of researchers' professional identities, identifying key characteristics and discussing the processes of identity formation and the enduring stability of these identities over time. Chapters 6 and 7 built on this foundation by establishing that science communication and advocacy are generally perceived as roles inherently linked to the identity of a researcher. These chapters offered an in-depth analysis of researchers' specific roles and responsibilities when enacting their professional identities within these contexts. The current chapter addresses the project's overarching aims by investigating why certain researchers engage in advocacy-based communication while others do not. It explores the factors that facilitate or hinder researchers' participation in various forms of communication, ranging from science communication to advocacy.

Additionally, the chapter examines the outcomes of these communicative efforts, with particular attention to the consequences of advocacy-driven communication. Real-world examples are employed to illustrate the enactment of researchers' professional identities, with a focus on the implications of identity threats arising from role conflict and ambiguity. These lived experiences offer critical insights into researchers' challenges as they navigate potential conflicts between their roles, highlighting the impact of role ambiguity and conflict on their professional identities.

8.1 Factors that Act as Facilitators and Barriers

Participants described factors that can act as facilitators and barriers to researchers' engagement in science communication, depending on the individual and context. Several factors were discussed by participants and are outlined below.

8.1.1 Time

Participants described having the time to invest in communication, which could act as a facilitator or a barrier to their engagement in communication. Specifically, this was spoken

about in terms of having a lack of time. For example, '[Advocacy] can be really time consuming' [INV006] and 'Look, it's time consuming. You've got to do training, you've got to be skilled at it' [INV017]. Time was also described as a balancing act between all the other requirements placed on researchers in their professional roles. For example, 'Time is valuable. That's time that you can't spend on writing papers, prepping for classes, writing research grants… our time is incredibly fucking valuable' [INV011] and:

> The current academic system doesn't [make it easy]. So a lot of my colleagues just say… I don't have time for the rest of it. I'm just going to focus on [publishing] because I want to get promoted. I want to stay relevant. So, they just discard the rest of the communication aspect of things. [INV015]

This indicates that while researchers may possess the motivation and intention to engage in communication, time constraints hinder their capacity to do so effectively. These external factors, beyond the researcher's direct control, have the potential to result in adverse consequences such as role conflict. This conflict arises when the societal role researchers perceive they should fulfil, as researchers, diverges from what they can realistically achieve owing to these constraints.

8.1.2 Training

Participants described having adequate training in communication as a facilitator and a barrier, with this often being spoken about by participants as not having been provided enough training. For example, 'I think there's a hole in our education and nobody ever taught me [how] to deal with media query or about the importance of translation' [INV009], 'I think it [science communication] should be an essential part of research training' [INV007] and 'I think communicating a complex idea in a straightforward kind of way is a skill that not everybody has. And I think we could do more to develop that in academia' [INV013]. Another participant noted that:

> I do think that there could be more structural incentives to encourage people to do it [science communication]. Or to support them to become more skilled in it. Because I suspect there is a group of people who probably would [do it] if they'd been somehow encouraged to do it more. [INV012]

Again, this indicates that while researchers are willing to engage in communication, a perceived lack of training impedes their ability to do so and affects their confidence in the type of communication they engage in.

8.1.3 Cultural Norms

Cultural norms were identified as a factor influencing willingness to communicate about science. Cultural norms were discussed in terms of the shared expectations and rules of behaviour that are associated with being a researcher, with these norms dictating how participants should engage in communication. Specifically, the expectation is that if you receive public money, you have an obligation to communicate those findings and to open up your science for review. For example, 'I think that we have an obligation to, you know, spend the money that we're given and the gifts that were given to try to create some type of positive change' [INV015] and ' … part of the scientific process is the obligation to communicate your results and to open them up to criticism and critique by the rest of the community whether that's your scientific community or whatever' [INV009]. Consequently, the shared expectations and rules of behaviour that are associated with being a researcher influence researchers' choice to engage in communication.

8.1.4 Fear of Misrepresentation

Participants described the risk of potentially being misrepresented as a factor that impeded effective communication. Specifically, participants described concerns that their words or intentions could be inaccurately portrayed or misinterpreted by the media, leading to misunderstanding by the public. Participants discussed this as having a lack of trust in the

media. For example, ‘There’s always a potential that they’re [the media] going to twist your findings and that has happened with my research in the past’ [INV015], with another participant stating:

> I’ve been burned by media in the past as well. I’ve realised how easy it is for your disclaimers to get cut out or the nuance to be lost. The sound bites to get picked out, and then you’re associated with the soundbite that you might not necessarily agree with. [INV004]

Participants anecdotally recounted that researchers chose not to engage owing to the risk of being misquoted. For example, ‘I have a lot of friends who just refuse to speak to them [the media] because of other previous bad experience or they just don’t trust what’s going to be printed’ [INV008] and ‘I know that journalists are going to screw it up… [a scientist that I know] just stopped doing it for the most part, because he was so sick of being taken out of context, when people screw it up’ [INV011]. Another participant described the implications of being misquoted:

> I remember years, and years, and years ago being interviewed by a local journalist here and I said something in an interview that was misconstrued by that journalist. I remember a skin cancer doctor writing to the paper and saying something about them being ill-informed and I was devastated. But it was because I’d been totally taken out of context. [INV002]

Interestingly, however, there may be instances where researchers may use the misinterpretation from the media for their benefit. For instance:

> It may suit, that particular scientists, to have things misrepresented in that way [in the media] because the funding is coming… They may or may not be deliberate in that. I’m not necessarily accusing anyone, but yeah, I think you just got to be careful. [INV004]

Participants identified the fear of misrepresentation as influencing their decision to engage in communication. This fear may also influence participants' choices when deciding what mode of communication they engage in, leading them to refrain from engaging in communication likely to be sensationalised (such as advocacy).

8.1.5 Perceived Risk to Reputation

Participants described the perceived risk to their reputation as affecting their choices in relation to communication. This risk was discussed in terms of the potential damage to the reputation of researchers. For example, '[Advocacy] comes at a reputational risk' [INV027] and 'The damage that can be done is reputational damage to the institution, it can [also] be personal damage' [INV003]. Additionally, this reputation damage can also cause judgemental attitudes to develop within the scientific community; for example, '[The risk of advocacy is that it can damage] their reputation, it can be damaging both from a public sense and from a professional sense because if I see somebody out there just speaking bullshit my perspective of them professionally will just plummet' [INV029]. This type of judgement highlights that even though there is general consensus of one large 'in-group' of science as a whole, if someone is perceived as damaging the outward perception of that overarching 'in-group', then that individual is viewed negatively or poorly by their peers, creating a social comparison between groups.

Risk to reputation was also described as linked with participants' career stage. For example, 'I heard young researchers on [a] number [of] occasions saying things like oh I can't do that till I get tenure… because I'm too young and if I write a popular article it's regarded [as] very unseemly' [INV001], with another participant saying:

> It's okay for [eminent scientist] to do this [advocacy], at the end of his career because it's the end of his career right. But if you're a young researcher and you go out in a really advocacy role your independence will be challenged. [INV021]

Another participant reported:

> I don't really want to have a big media profile because I think about where I'm at, the stage of the career I am [at], and in particular having two young kids at home. I don't want to be the face on television [that people go] that's their dad. [INV030]

8.1.6 Societal Expectations

Participants described societal expectations in terms of both the shifting baseline of science within society and how science is viewed as a factor influencing their choice to engage in communication. This consideration resulted in some participants changing their perception of their professional roles as researchers. For example, 'Expectations about… what a scientist does, what they deliver and how they go about delivering it has totally changed' [INV021]. This has the potential to cause internal role conflict for the researchers, between how they think they should act in line with their identity and external pressure on them to act according to a new role or social norm ascribed by society. Interestingly one participant describes this as not the researchers changing but rather the environment around the researcher that is changing. For example:

> Now you have conservative government's actively attacking all science. Not just climate change, but just science in general. Hell, you have the Australian government now just attacking universities... basically it's not scientists changing in my opinion, it's the world around scientists changing. [INV011]

Importantly, this shift was not always viewed in a negative light. For example:

> Science is becoming more and more tied to addressing problems… and all of these things that are happening on the planet. And people from different disciplines have to work together in order for that to happen… When you get people from the Natural and the social sciences and the economic sciences—working with industry and

> stakeholders and decision-makers and end users… It creates a whole different role for science because it's much more integrated with society. [INV015]

8.1.7 Incentive Structure

Participants highlighted the systems and mechanisms that motivate and reward researchers for their work as potentially influential factors in their engagement in different modes of communication. Specifically, two key components of the incentive structure in science were identified: *performance metrics* and *funding*.

8.1.7.1 Performance Metrics. The addition of performance metrics associated with researchers' professional roles is a clear example of incentive structures acting as a barrier that researchers must navigate when choosing to communicate. As reported by participants, performance metrics can potentially influence researchers' decision-making regarding the communication of science. For example:

> We're under a lot of pressure to perform and to have these metrics… Specifically, we get evaluated and promoted on the basis of how much funding we bring in, and how many articles we produce. And so, any time that we spend not doing that… is basically taking away from that. Engaging with stakeholders, having an impact [in] science communication that's not something that's really… accounted for in evaluating your sort of research prowess… but that is changing. [INV015]

Another participant stated:

> In terms of our research metrics and performance indicators for promotion [it] is still about citations. It's not about how many times do you actually engage with the media. You can use that as a metric, but it's not valued anywhere near enough. So when you have publish or perish, when that is the mentality [in] a university, it is about getting those A-star journals. In my field there is one journal that all practitioners use, that's the journal that I actually target, its free, it is online, it is Open Access and

> practitioners all across Australia use it. But it is not an A-star journal so in terms of research metrics it's not actually valued by the university. [INV031]

Performance metrics were discussed as factors that divided researchers' attention, indicating that they could not devote sufficient focus to science communication while also addressing other performance metrics more highly valued by institutions for promotion.

8.1.7.2 Funding. Several participants identified funding as a factor affecting the mode of science communication in which they chose to engage. Specifically, participants noted that involvement in certain forms of communication might be perceived negatively by individuals external to the scientific community, potentially jeopardising their ability to secure future funding. This consideration is particularly important for researchers because obtaining funding is crucial for career advancement. For example, 'Once you're labelled an advocate you'll always be seen as an advocate. That's likely to affect your ability to get funding' [INV023]; 'If not done right, if not done appropriately and respectfully [advocacy] could cost career and loss of funding and that… happens all the time and it will continue to happen' [INV033]; 'We certainly see evidence from governments from time to time of, you know, bias in the way that grants are given out because people may have become advocates and they don't want to basically reward that behaviour' [INV025]; and '[Researchers don't want to stick their head up and communicate] because of the way science is funded in Australia and you don't want to bite the hand that feeds you' [INV016]. Another participant stated:

> There's personal costs, potentially, in terms of who funds you in future and who doesn't. What jobs you can apply for and which [ones] you can't once your public opinion is known. For example, a researcher that I know… is very against the pastoral industry and he's been very vocal in public for a long time about how bad the pastoral industry is to the environment. Then [he] tried to apply for some money from the pastural industry, and then is really surprised when he didn't get the money. You can't

> just rubbish people and then expect them to give you money…not going to happen. [INV004]

Another participant stated:

> I know that when I do speak up and managers and those funding agencies hear it that it's going to come back and I'm probably not going to get the funding I want or need to keep things going. And so, I'm really cautious about that. [INV033]

Interestingly there were some examples of participants discussing the need for researchers to engage in advocacy communication to continue to get funding for their line of research. For example:

> Right now we're in a position where the competition for funding is extremely strong. And so, if you work on a threatened species, you are more likely to get money than if you don't. And so, there's strong advocacy to get species on threatened species lists. Now I don't think that there's anything on [the] threatened species list that doesn't belong there, but I do think that it mattered. [INV024]

The necessity to advocate for funding to sustain their research indicates a potential conflict for researchers between their commitment to conducting research they consider valuable to society and engaging in communication that aligns with their professional values. Incentive structures, such as performance metrics and funding, play a pivotal role in shaping the goals and activities of researchers, influencing both the research they undertake and the manner in which they communicate their results. Additionally, researchers' identities are deeply connected to their capacity to benefit society, with their roles as researchers intrinsically linked to their ability to effect positive change. Consequently, the potential loss of funding poses a significant threat to these aspects of researcher identity.

8.1.8 Institutional Priorities

Institutional priorities in terms of the specific objectives, goals and areas of focus that academic institutions, funding bodies, and governmental agencies prioritised in their support and promotion of scientific endeavours were described by participants as affecting their engagement in different forms of communication. For example, 'While I've got contracts with [government organisation] and confidentiality agreements and stuff [science communication and advocacy is] a grey area and I can't do that' [INV020]. Furthermore, participants described that if their institution receives specific funding, then researchers within that institution may be cautious about how they choose to communicate. For instance, 'A lot of scientists probably won't necessarily put their neck out… they don't necessarily have the luxury of saying [advocacy-type communication] because [of] very complex political relationships [and] funding relationships' [INV016]. Another participant stated:

> So, a lot of [my] funding is from ports which is shipping coal. And so, a comment around climate change, I'd have to be a bit careful about how I would do that. So just being a bit sensitive to that [with] funding that comes through. I don't think I'd be, as I said, most impactful by making comments like that. [INV033]

The consequences of this were nicely described by one participant:

> Ultimately, because I'm a public servant, I'm even more bound to, not share my views on things. Essentially, I'm at risk of losing my job if I would… criticise policy. … I've grappled with it occasionally… most people in my situation at one stage or another have grappled with whether they should be a whistle-blower... I've certainly seen things that I think were egregiously wrong… For me I just weigh it up on the pros and cons and [the likelihood] of actually changing something. I'm the kind of person, I'll speak up to the point where I think I have an influence but I also recognise there's a point where my influence drops off. [INV023]

8.1.9 Summary

Participants reported several factors that act as facilitators and barriers that influence researchers' engagement in science communication, depending on the individual and context. Many of these factors do not occur in isolation and may simultaneously promote and impede researchers' engagement in communication.

8.2 Outcomes of Communication

Participants described several outcomes of their engagement in public-facing communication: *increased funding opportunities, policy impact, personal safety concerns, emotional toll and credibility*. Often these outcomes were specifically identified by participants as consequences of advocacy-driven communication.

8.2.1 Increased Funding Opportunities

Participants describe that there are times when engaging in communication can be beneficial and aid in getting funding. For example:

> But the reality is that… the value that you generate from your science is actually much greater if you communicate that more widely. And that's the important role that scientists [play]. They recognise in doing that, it is not only good for society, but it can also be good for you as a scientist. Because getting that message out there says to people… I'm doing this work… helps you generate further work… get funding, all these sorts of things. So, it's not something you do just completely altruistically. It's something that actually is beneficial and… in some ways, I guess [it] grows your brand and your reputation as a scientist. And that you can do science that is useful or whatever it is that you're trying to achieve. [INV025]

Interestingly, the recognition that science communication may not solely serve altruistic motives appears to conflict with several fundamental mechanisms that underpin researchers' identities. Consequently, researchers may experience discomfort when they

perceive personal benefit from communication efforts. This situation may engender a perceived balancing act between securing funding to advance research deemed beneficial to society and acknowledging any perceived self-serving aspects associated with funding allocations.

8.2.2 Policy Impact

Participants described the potential for policy impacts as a consequence of communication. Specifically, researchers' describe their influence over informing policymakers, reforms based on scientific insights and increased awareness among decision-makers and the public about scientific issues. For example:

> I think about times that I've worked for government agencies, or when I sit on advisory panels… I know the people in government and NGO's… or industry will look at those scientists, that are really powerful advocates and they will just be going… I'm not sure if I want to try and engage there. [INV022]

Another participant stated:

> There are a lot [of policymakers] who recognise that there is a suite of scientists who are basically issue advocates, because that's how they act… It may not necessarily [be] when they directly communicate with the policymaker but… [when they communicate] through places like the media or Twitter or whatever… It can become very obvious. [There is a] risk involved in this, and it can be the risk for the individual, but… more broadly… it can be a risk for science and the use of science in decision-making… As more scientists have become advocates… the distrust of policymakers with science as a fundamental process… that underpins decision-making has become poorer because… they can't necessarily trust the scientists that are presenting the science to them… That breakdown is the greatest risk of all of this. [INV025]

Furthermore, damage in influence seems to result from a perceived view that researchers will be seen as biased and potentially untrustworthy by engaging in this type of hard-line communication. For example:

> Some scientists are very blunt and… they believe absolutely in what they want to communicate. So, they will say things like, take all cars off the road, shut down coal mines… That can be very damaging because that's when you sometimes will get a lot of blow back from the public. Then that results in kickback on policy, kickback on funding [and] government decisions. [INV002]

The loss of capacity to inform policymakers, influence policy through scientific insights, and raise awareness among decision-makers and the public through communication could challenge what participants emphasised as a crucial aspect of their role as researchers: effecting societal change. Encountering such consequences may provoke internal conflicts among researchers regarding their perceived value and position within the scientific community and broader society, potentially challenging established norms within the scientific community.

8.2.3 Personal Safety Concerns

Participants highlighted *safety concerns* as a consequence of communicating. This was most often discussed in terms of advocacy-type communication. Several participants reported the possibility of death threats that may be levelled towards researchers as a result of their communication. For instance, 'One of my colleagues… he has death threats that are brought against him and so there is a risk and I can see why some people may not want to do that' [INV026] and 'I know people who have personally received death threats' [INV020]. Other participants said:

> In some cases, now, especially with Twitter and right-wing trolls, you have people who are stepping into [an] advocacy role being actively attacked… Having their lives

> threatened… Um it's scary to be a public person on a topic that pisses off conservatives in the US. [INV011]

Another participant stated:

> I have colleagues who have received death threats because of that stuff they've had in the media. There are reporters who work for certain publications in Australia who will defame people… in some of the [contentious issue] reporting. So… it's a fraught space and it's one that requires quite careful consideration. I'm of the personal opinion that not all scientists think very carefully about whether they do that. They see the chance for a bit of fame rather than… communicating good reliable information. [INV025]

8.2.4 Emotional Toll

Participants identified *emotional toll* as a consequence of engaging in advocacy-type communication. Specifically, this burden was articulated in terms of the profound emotional strain experienced when dedicating one's career to effecting societal change, only to witness persistent challenges such as the ongoing decline of a species despite extensive efforts and lifelong dedication to its conservation. For example:

> One of the biggest costs [of engaging in advocacy] is probably emotional and mental just through the nature of advocacy. Doesn't matter what you are advocating for, the nature of advocacy requires intense amount of emotional investment. Because your primary driver is your passion, is your innate desire to want to change, your motivators not a pay packet. Because you are literally pouring in your heart, soul, blood, sweat, tears it can take quite an emotional toll. Particularly when it doesn't go your way, because then you feel a sense of failure which then creeps into identity guilt. [INV016]

The same participant continued to say:

> What is unique to advocacy, and I didn't fully appreciate it… [is] vicarious trauma… What I realised… was that whilst you're not personally affected as such… the vicarious trauma I feel from [not being able to save animals]. Rationally, you know it's not your fault, you know it wasn't because of me that they changed the laws. But you just feel like something I did or didn't do… and the thing is you see it play out.… because you've invested so much emotionally. You can feel the repercussions. [INV016]

8.2.5 Credibility

Participants discussed *credibility* as a consequence of engagement in certain forms of communication. Participants' discussions primarily centred around how this communication might influence their credibility as researchers. For example, 'I don't think that [advocacy is] something that I would want to get involved in, because I think it would detract from the credibility of my objective space' [INV015], 'People who are active in advocacy sometimes get tarred as they've lost their impartiality as scientists' [INV020], 'Primarily it can lead to you being seen as less then objective' [INV027] and 'Depending how far along that spectrum you go, your independence should actually be challenged… and your role as a scientist, and how you see your role… there really needs to be some reflection about that' [INV021]. Another participant stated:

> They [scientists] should be aware that it [advocacy] comes at a risk. At personal risk and reputational risk. Science as an endeavour is built on trust, and if that trust is called into question either because you're a dodgy operator, or because you're smeared or your work is twisted [be careful of that]. [INV027]

Participants described an outcome of this credibility issue as affecting their objective voice. For example, '[In advocacy] there's concerns about independence, about subjectivity and bias' [INV027]. Another participant stated: 'I also do think there's an issue with

scientists being labelled as all advocates. So if the average person sees a scientist is not being neutral and [not] basing things on the facts. That's problematic' [INV011].

Engaging in advocacy can introduce credibility challenges for researchers, as it involves advocating for specific positions or policy outcomes that may intersect with personal or institutional interests. One participant provided a clear example of this:

> So, we have had trouble… we were studying [species] recovery and we found that some species were recovered. And we had advocates in our group [who] were saying you can't publish that, everyone's going to think it's fine. Everyone is going to think [issue] is no problem—which is true that is how people think. But it's also I think important not to become such an advocate that you start filtering your science. And so you have to be able to publish what it is you find, and you have to be able to see what you find. Because that's the other thing they were saying oh well… you know these [species] populations are not going extinct but lots of them are dying… concentrate on that. And I was like, 'no!' The point is that even though lots of them are dying the populations aren't going extinct, that's really important. And so, I do feel like that can be a real problem in advocacy. [INV024]

Additionally, credibility was further discussed by participants in terms of damaging the public's trust in science. For example: I think about [recent contentious science situation]… it's divided the public, it's eroded people's trust [in science]' [INV015] and 'science as an endeavour is built on trust and if that trust is called into question either because you're a dodgy operator or because you're smeared or your work is twisted [that is dangerous] [INV027]. Furthermore, this speaks to a ripple effect that could potentially exacerbate existing societal issues of public distrust towards researchers. For example, 'I'm not sure that the public trusts scientists anymore' [INV020].

Maintaining credibility was seen as essential for preserving trust in the researchers' objectivity and expertise. For instance, 'Once you stray into the realm of advocacy… you can no longer be perceived as objective and therefore the value of the work you do is inherently tainted' [INV019] and:

> Where I'm torn [is where advocacy] can inform the situation. Especially if there are polarised views on the topic and it becomes a matter of media interest or political interest. I think it's a really dangerous thing for scientists to get into the advocacy sphere. Because I think the moment you do that you can be presented as being biased one way or the other, and it has a potential to devalue your work. [INV023]

Participants describe credibility issues when researchers engage in certain forms of communication. These credibility challenges relate to the loss of their own perceived credibility in the eyes of the public, which affected the public's trust in science more broadly. This discussion indicates that advocacy-type communication can threaten science's objectivity, which is a core part of the researcher identity (i.e. working in facts and truth).

8.3 Conclusion

This chapter presents facilitators and barriers that influence why some researchers engage in advocacy-based communication while others refrain from doing so. The chapter also explored the outcomes of such communication practices, with a specific emphasis on the consequences of advocacy-dominant approaches. Through an exploration of the facilitators and barriers shaping researchers' involvement in various forms of communication—from traditional science communication to more advocacy-oriented efforts—this analysis has provided a clearer understanding of the complexities underlying these choices. These factors have implications for identity threat due to role conflict and role ambiguity. For instance, societal expectations, incentive structures and institutional priorities indicate a subtle shift in societal expectations of researchers. Concerningly, if researchers' perceptions of their own

roles have not aligned with these evolving expectations, a disconnect may emerge between the social norms upheld by researchers and societal expectations, leading to role conflict and ambiguity. However, this shifting expectation on researchers has led them to become, in some cases, more collaborative and interconnected, creating a stronger, more cohesive in-group. There is a potential for these changing expectations to act as a protective mechanism for role conflict or role ambiguity, consequently facilitating the further entrenchment of the social norms that researchers hold as a professional in-group. However, consolidating a researcher professional identity may further perpetuate the disconnect between researchers' social norms and societal expectations.

Additionally, participants reported that the 'publish or perish' model and changes in research funding in Australia impose further contextual pressures on researchers, influencing their engagement in different forms of communication. The dichotomy between these two often mutually exclusive notions has the potential to push and pull researchers and shift how they choose to engage in science communication. For instance, communication may feel like a requirement of the role of a researcher. However, when this communication may affect the funding that a researcher receives (affecting their ability to continue to do the research they feel is valuable), this has the potential to cause identity conflict. This conflict effectively creates a juggling act between opposing aspects of their identities, their need for transparency and honesty, and their need to continue doing meaningful research for society. Consequently, while researchers may not feel comfortable engaging in certain forms of communication, they feel pressured to do so to be able to continue to do the work that is a key component of their professional identities, thus alleviating role conflict.

Identity threat and role conflict were further exacerbated by the lack of trust participants felt towards the media. This lack of trust in the media can once again cause conflict for participants because a strong component of their identities as researchers is a

desire to help society and make a difference with participants noting one way to do this is via communication. Consequently, when researchers feel unable to communicate effectively, this can, at times, be perceived as counter to their identities as researchers. Additionally, a strong element of researchers' identities is their desire to be transparent and honest. Therefore, when researchers perceive a disconnect between what they say and how the media portrays them, this has the potential to be in opposition to elements of their identity, such as a desire for transparency and honesty. This disconnect has the potential to cause internal struggles, such as role conflict. The ability to influence was an important function of researchers' identities and speaks to their reported innate desire to help society or help facilitate societal change. If a researcher values the potential influence they have, they need to be careful when considering what type of science communication they engage in, as they may find themselves being counterproductive to fulfilling their identity as a researcher and the role that they see themselves playing within society.

These facilitators, barriers and outcomes are necessary to understand as they underpin researchers' willingness to engage in all forms of science communication, potentially undermining the credibility of science amongst policymakers and the public. Often, addressing these requires institutional support, changes in incentive structures, improved training programs and a cultural shift within the scientific community to recognise the importance of science communication. An in-depth discussion of these results is provided in the next chapter, alongside a thorough exploration of the practical suggestions to overcome the issues identified throughout this thesis.

Chapter 9: General Discussion

This research adopts a social identity approach within a professional identity framework to examine why some researchers engage in advocacy-based science communication while others do not. Specifically, this thesis investigates researchers' perceptions of their professional roles and identities in relation to science communication and advocacy, as well as how they interpret the interaction between these domains. A review of the literature (Chapters 1–3) determined that an exploratory qualitative study (Chapter 4) was most appropriate to achieve the project's aims; the results of these investigations are presented in Chapters 5–8. This final discussion chapter summarises the research and evaluates how the preceding chapters collectively contribute to the project's overarching aims. This concluding chapter commences by reviewing the key findings and highlighting their role in explaining how researchers' identities and professional roles shape their decisions to engage in various forms of science communication, including advocacy. This chapter then moves to a discussion of the theoretical implications, proposing an original integration of SIT and SCT to explain the development of researchers' professional identities. The practical implications of the research are then examined, leading to the introduction of the 'science-communication, science-advocacy continuum'—a novel model of science communication presented in this thesis—before concluding with an analysis of the project's limitations, recommendations, and prospects for future research.

9.1 Summary of Research

9.1.1 Researcher Professional Identity

Overall, participants articulated a professional identity as researchers in remarkably similar terms, reflecting a stereotypical view that aligns with Western societal norms of what constitutes a *researcher* (Carli et al., 2016; Chambers, 1983; Ferguson & Lezotte, 2020). This consistency suggests a well-defined and widely recognised professional identity within the

scientific community. Furthermore, participants described the development of their professional identities in ways that align closely with existing literature on the subject, indicating a shared understanding of this developmental process (Adams et al., 2006; Ashby et al., 2016; Burford, 2012; Estrada et al., 2011; Nadelson et al., 2017; Park et al., 2018; Price et al., 2021). The stability of a researcher's professional identity was evident across different participants and throughout an individual's career, underscoring the robustness and longevity of this identity. These findings suggest minimal variation in how researchers perceive their professional identities; however, variation exists in conceptualising the roles researchers should portray and are expected to undertake within their jobs and society. Participants frequently discussed role conflict and the evolving nature of the roles that researchers are expected to undertake, reflecting a lack of consensus on specific roles. This ambiguity regarding the roles researchers should play may explain the diverse approaches to science communication observed among researchers. Specifically, it may account for the differences in why some researchers choose to engage in advocacy while others do not, which will be explored further below.

9.1.2 Science Communication

Participants generally agreed in their perception that researchers do have a role to be science communicators. For instance, participants acknowledged that although they believe that all *science* should be communicated, they do not believe that all *researchers* should be public communicators. This difference can be seen in different interpretations of their role, their definition of what science communication is and what they understand their responsibility to be given their interpretation of their role. Specifically, in this role as a science communicator, participants identified their responsibilities as science communicators. Three themes were identified here: *honesty*, *objectivity* and *rigour*. According to participants, the role of a researcher within science communication was to publish academic papers,

present at academic conferences and engage with community groups, government representatives, the media and industry representatives. Participants reported that researchers then have a responsibility to ensure the integrity of science is maintained through honesty, objectivity and rigour, with these themes discussed by participants in terms of evidence-based communication, transparency, communicating within their area of expertise and acting as a fact checker. Researchers are motivated to communicate because of the importance or relevance of the research for society and/or employment, funding or contractual obligations.

9.1.3 Advocacy

Chapter 7 concentrated on participants' opinions towards advocacy, specifically whether researchers should be engaged in advocacy and the identified roles and responsibilities associated with the researcher's engagement in advocacy. There was significant variability in participant opinions in relation to advocacy. While some participants reported that researchers have a role as advocates through being facilitators of information transmission, others did not believe researchers should engage in advocacy, and others believed engagement in advocacy was conditional upon contextual factors. Similarly to science communication, participants discussed researchers' responsibilities when engaging in advocacy-type communication. There were several parallels between participants' reported responsibilities in science communication and advocacy; specifically, participants underscored the importance of maintaining scientific integrity in advocacy through adherence to objectivity, honesty and rigour. However, while there were parallels, participants clearly distinguished advocacy responsibilities from those associated with science communication. In particular, participants emphasised the necessity for thoughtful and respectful engagement and the maintenance of ethical standards and personal integrity when participating in advocacy efforts. This differentiation was further evident in participants' discussions of their motivations for engaging in advocacy, which often centred on power considerations, such as

the pursuit of increased funding or influence over policy, in addition to personal and disciplinary norms.

9.1.4 Factors Influencing Modes of Engagement

In Chapter 8 there was an examination of the barriers and enablers which influence researchers' engagement in advocacy-based science communication and an exploration of the consequences of adopting more advocacy-dominant approaches to science communication. The current chapter explores these complex and interrelated factors that shape communication practices and highlights the implications for identity threat, role conflict and role ambiguity. Societal expectations, incentive structures and institutional priorities have shifted, sometimes creating a disconnect between researchers' professional norms and societal demands, which can exacerbate role conflict. While these shifting expectations can foster greater collaboration and cohesion among researchers, they may also reinforce professional in-group norms, further distancing researchers from societal expectations. Additionally, external pressures such as the 'publish or perish' model and changes in research funding in Australia contribute to this tension as researchers navigate the balance between transparency and maintaining research viability. The perceived disconnect between researchers and the media exacerbates role conflict, as researchers' desire for transparency and societal impact clashes with media portrayals. These dynamics underscore the need for institutional support, revised incentive structures and improved training to mitigate the barriers to effective science communication, which, if unaddressed, could undermine scientific credibility.

9.2 Theoretical Implications

This research has produced findings that have numerous theoretical implications for furthering our understanding of professional identity, SIA and the contemporary landscape of science communication. This research introduces a novel integration of SIT and SCT within

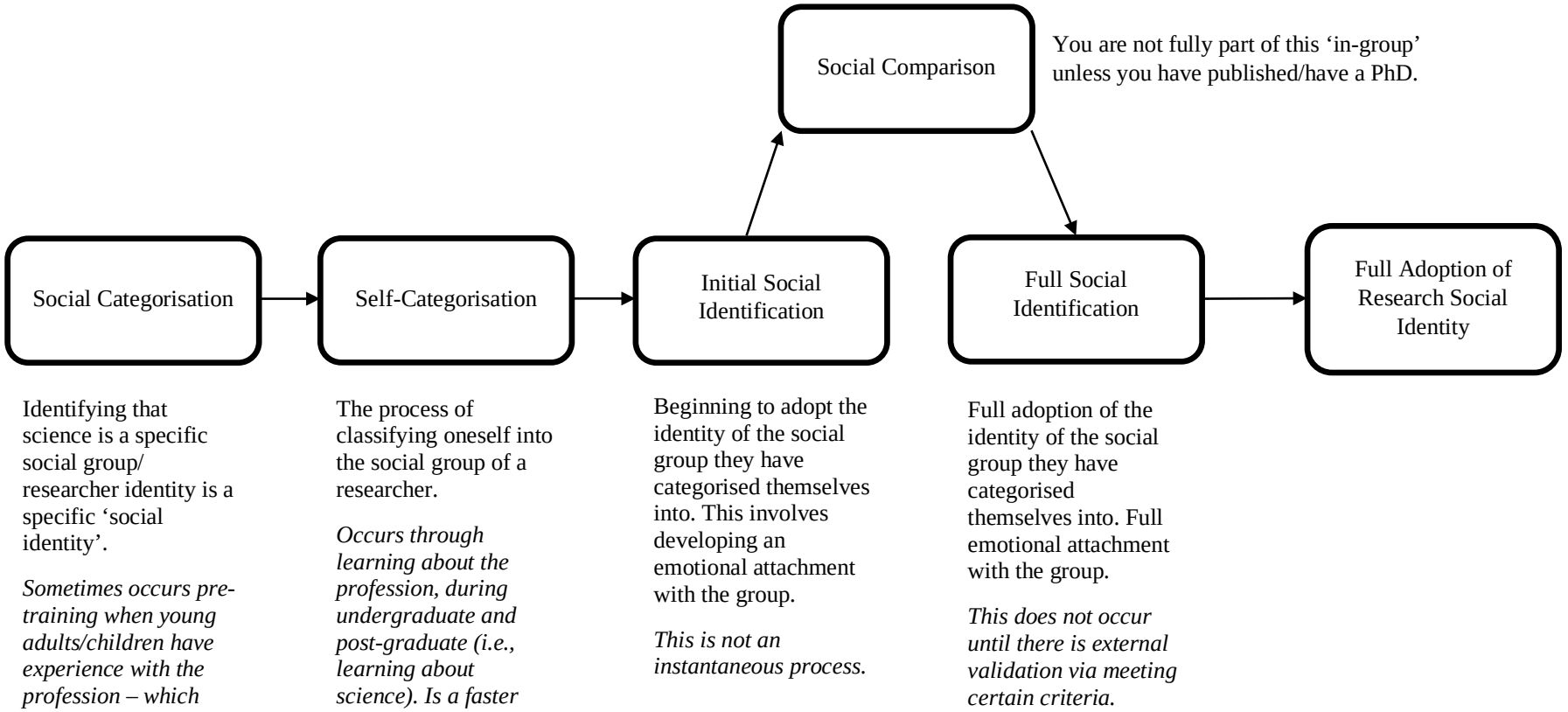
the broader social identity approach, offering a framework for understanding how individuals develop their professional identity as researchers.

9.2.1 Social Identity Approach

Both SIT and SCT, within the social identity approach, provide valuable insights into group dynamics and identity and were acknowledged at the beginning of this thesis as theoretical perspectives to understand the development of researchers' professional identities and these identities in the context of science communication. These complimentary theories address different aspects of identity formation: SIT emphasizes the social and emotional processes involved in the development and maintenance of professional identity, while SCT focuses on the cognitive mechanisms through which individuals come to identify with a professional group (Abrams, 1990; Abrams & Hogg, 1990; Hogg, 2016; Tajfel & Turner, 1979; Turner et al., 1987). Consequently, Figure 9.1 presents an integration of both theories to explain the development of researchers' professional identity.

Figure 9.1

Integration of Social Identity Theory and Self-Categorisation Theory to Explain Professional Identity Development



From a social and emotional standpoint, SIT emphasises how individuals derive a sense of identity and self-esteem from their membership in social groups (Tajfel & Turner, 1979). Applied to professional identities, SIT explains how individuals align themselves with professional groups and how these group memberships contribute to their self-concept. SIT stipulates that belonging to a professional group can enhance self-esteem and influence behaviours to conform to group norms. SCT, a development within the broader SIA, describes the cognitive processes involved in group identification (Hogg & Terry, 2000; Turner et al., 1987). Specifically focusing on how individuals categorise themselves and others into groups, leading to depersonalisation, where the self is defined in terms of group identity. SCT explains the cognitive mechanisms behind professional identity formation, explaining how individuals come to see themselves as members of a professional category and how this categorisation influences their perceptions, attitudes and behaviours in the workplace (Hornsey, 2008).

SIT provides a foundational understanding of how group memberships influence self-concept and explains how professional identity is formed and maintained (Tajfel & Turner, 1979). In contrast, SCT explains the cognitive mechanisms behind how an individual comes to identify with a professional group (Turner et al., 1987). While SIT and SCT are used together to explain how researchers develop and embody their professional identities, neither theory can adequately capture the complex interplay between professional identity and the diverse roles researchers undertake. Specifically, both theories propose that an individual holds multiple identities and the salience of each situation influences which identity is activated in which context (Tajfel & Turner, 1979; Turner et al., 1987). Therefore, neither theory can explain the findings of the current study, which indicates that a researcher's professional identity remains stable and unchanging while embodying varying roles, which are often at odds with each other and with their identity. For example, researchers engage in

advocacy not solely owing to strong group identification but also because of ethical considerations, institutional pressures and personal convictions about the societal implications of their research. However, recent theoretical developments within the social identity approach suggest that advocacy may still be interpreted as an identity-congruent behaviour, particularly when group norms encompass values such as public engagement, responsibility, or care for broader society. When professional identity is deeply internalised and fused with moral or prosocial group norms, behaviours that appear altruistic—such as science advocacy—can be understood as expressions of the collective self (Ellemers et al., 2002; Thomas, McGarty, & Mavor, 2009). From this perspective, advocacy is not necessarily at odds with professional identity but may instead reflect its most socially engaged form. Although the current study found that advocacy is often shaped by ethical, institutional, and personal influences, the social identity approach offers a valuable lens through which to interpret altruistic action as an extension of professional group identity when that identity includes a commitment to the public good.

9.2.1.1 Professional Identity. The findings of this research identified key characteristics of a researcher contributing to participants' self-perception, with these characteristics explained via self-categorisation and contributing to their professional identities as researchers. These characteristics align with previous research identifying the characteristics of a researcher, demonstrating consistency regarding the underlying characteristics that make someone a researcher (Hancock & Walsh, 2016; Mantai, 2017, 2019a). The consistency between the current research and the literature also suggests that these characteristics may be foundational to the researcher identity. The fact that many participants felt these characteristics applied to researchers regardless of their discipline suggests that researchers conceptualise themselves as part of a larger science in-group, identifying more with the overarching principles of science, such as the scientific method,

rather than with their specific discipline or other possible roles such as academics or teachers. This suggests there is no social categorisation into in-groups and out-groups *between* the science disciplines. Rather there is a superordinate group that all participants identify with, and which was the most salient to participants, particularly in the context of science communication. This salience means that researchers engage in social categorisation into the social group of science and adopt the identity of the social group they have categorised themselves into (social identification).

These findings of an overarching, superordinate group also suggest that the self-categorisation process into the 'science' social group may occur before alignment with specific disciplines, suggesting that there are more important things that motivate and drive researchers than discipline-specific norms. This study and previous literature indicate this categorisation process begins early in a researchers' career as they start to identify with the broader scientific community (Barnard, 2019; Robnett et al., 2018; Tomlinson & Jackson, 2021). This self-categorisation shapes how researchers perceive their roles, responsibilities, career trajectories, and how others perceive them within the scientific community (Hogg & Terry, 2000).

There are also parallels between the fundamental characteristics of the researcher identity described in this study and the stereotypical characteristics of researchers seen within society observed through mediums such as the media and literature (Aschbacher et al., 2010; Barnard, 2019; Hancock & Walsh, 2016; Mantai, 2017; Robnett et al., 2018). This indicates the influence of social and cultural factors on researchers' professional identity and may potentially facilitate the depersonalisation process observed within SCT. Though the direction of the relationship between researcher identity formation and societal expectations of researchers is unclear, it nonetheless suggests that society does hold views and/or expectations of researchers that are shared and acknowledged by the researchers themselves

and have a consequential influence on the social norms and expectations on the ‘researcher’ identity.

The current findings not only speak to researchers’ professional identities more broadly but also support current literature on professional identity development, specifically that professional identities develop as a function of learning about the profession (Marvasi et al., 2019; Mula et al., 2022; Park et al., 2018; Robnett et al., 2018; Tomlinson & Jackson, 2021). Participants articulated that their initial conceptualisation of identifying as researchers was closely tied to their experiences of learning about science, with participants describing this through formal education, mentorship, peer interactions, professional experiences and conducting their own independent research. Consequently, the development of identity is achieved by internalising the core knowledge, skills, values, beliefs and roles of the profession, with this process of professional identity formation resulting in individuals acting, thinking and feeling like a member of that professional community. This process speaks to both the social categorisation and identification process seen in SIT and SCT, indicating that researchers’ identities are shaped by their social environments, professional experiences, and interactions with the scientific community and broader society (Turner et al., 1987). Interestingly, the notion of professional identity development through socialisation was described as providing legitimacy and solidifying participants' perceived value and worth as a researcher, highlighting the importance of both internal and external factors contributing to the self-categorisation process. These findings indicate that there are, in fact, parameters to the ‘science’ superordinate group, and a process of in-group and out-group differentiation is a function of learning about the fundamentals of science.

The point at which embodiment of identity occurs was not a fixed point for all researchers, with this at times occurring during undergraduate and other times during postgraduate training. Once again, this process of learning about and socialising into the

profession of a researcher is supported by social categorisation (identifying the specific social identity of a researcher and assigning themselves to that social category) and social identification (adopting the identity of the social group they categorised themselves into; Tajfel & Turner, 1979). As social identification involves developing an emotional attachment with the group, it seems logical that this would occur through learning about and socialising in the profession, given that this process does not occur instantly but requires time to build and develop those connections (Spears, 2011; Tajfel & Turner, 1979). Interestingly, some participants described social identification as occurring when they first published a paper and was conceptualised as a rite of passage for a researcher. The ‘right of passage’ suggests the need for external validation of identity or objective validation of individuals becoming researchers. The external validation to fully develop an attachment to the professional group suggests a process of social comparison embedded with socially identifying with the researcher profession. This is further exemplified by the reported requirement of obtaining a PhD to be identified as a researcher. This particular measure is looked for by participants when they are conceptualising what a researcher is, further supporting the notion that there is a process of in-group and out-group identification.

The process of in-group and out-group identification suggests that developing a professional identity involves not only self-identification with the group but also demonstrating adherence to its behavioural norms (e.g., publishing research or obtaining a PhD). This outward demonstration is essential for gaining recognition and acceptance as a member of the group. Participant responses suggest that the transition to fully adopting a researcher's social identity is not marked by a singular moment but rather represents a gradual development of professional identity, often culminating in meeting in-group requirements of obtaining a PhD. The variability in the point at which participants first felt like researchers may be attributed to disciplinary-specific differences and the timing of engagement in the

research process specific to each field. Nonetheless, these findings align with the broader professional identity literature, which indicates that the formation of professional identity occurs progressively throughout the training process and socialisation into the profession (Adams et al., 2006; Ligorio, 2010; Quartiroli et al., 2021). Furthermore, these results provide a clearer picture of how the mechanisms of SIT and SCT work together in the professional identity context and provide insight into how these theories apply in contexts that do not centre around prejudice and discrimination.

The strength and salience of the adoption of the researcher's professional identity highlight the stability of this professional identity. Participants exhibited high identity stability, meaning that their social identification, emotional attachment and full adoption of the researcher's social identity remains relatively unchanged over time, providing a coherent and enduring sense of self in relation to their professional identities. This enduring stability of researcher identity implies that the individual's core identity remains stable and resilient despite changes in external circumstances, career stages or specific research projects. The stability of the identity is important as it suggests that much of researchers' behaviour is guided by their professional identities. The stable identity may also explain why we see one single identity with corresponding roles instead of multiple identities.

One explanation for the stability of a researcher's professional identity is that they tend to fully embody this identity. As a result, it appears to become their primary identity rather than any other identity they may hold (such as father or brother). That is, the researcher identity appears to be more valuable or important to them than most other identities and is the driving value base for their overall worldview and how they perceive their role within society. The reason for this importance is likely owing to the foundation of this identity involving the tenets of science and the scientific method. The tenets of science align with the ontological and epistemological perspectives of researchers. That is, their philosophical

worldviews, their conceptualisations of the world, and how they choose to make meaning from the world align with that social group's foundational characteristics. Consequently, the alignment between the tenets of science and the researchers' ontological and epistemological perspectives then strengthens their association with that social identity. The complete embodiment of the researcher professional identity suggests the adoption of this identity as a core identity to researchers, indicating that the iterative social identity process, as discussed above, provides for a stronger integrated professional identity. This stability is crucial for professional development, career satisfaction and the ability to adapt to evolving challenges and opportunities within the research field.

9.2.1.2 Social Identity Threat. Social identity shapes and influences researchers' behaviours by creating roles with corresponding normative behaviours that govern how researchers act in situations (Bayerl et al., 2018). This thesis examines the behaviours associated with researchers' engagement in science communication, which participants identify as a distinct aspect of their professional identity. This thesis aimed to understand why researchers engage in different forms of science communication, with SIA explaining some of the variations in researchers' choices to communicate science. In the context of this thesis' results, social identity threat involves the concern that one's social identity is negatively judged or devalued by others, leading to psychological and behavioural consequences (Ashforth, 2000; Ellemers & Haslam, 2012). For instance, the repeated concerns for maintaining the integrity of science and the pressure that researchers feel to ensure they are always communicating clear and reliable information stems from a desire to maintain their social identity as researchers, particularly in the eyes of the public and policymakers.

Participants expressed concern that engaging in certain forms of science communication could risk undermining the credibility of science, particularly if the public or policymakers perceive them as biased or untrustworthy. The concern participants report is a

form of social identity threat where individuals fear confirming negative stereotypes about their group (Major & O'Brien, 2005), which in this context can affect how and why researchers choose to engage in different forms of communication and can impair the public's view of researchers. The outcome of this social identity threat can lead to reduced engagement and participation in communication. This again can be seen in the data when participants described changing their opinions regarding whether researchers should be engaging in science communication.

The risk of researchers' words or intentions being misrepresented by the media was another concern leading to a threatened social identity. Often, this is considered by other researchers and the public as the researcher publicly commenting or speaking out of turn, when in reality, it may be just a misrepresentation or misinterpretation of their words. The concern here is that this misrepresentation can lead to reputational damage to the science superordinate group. Consequently, judgemental attitudes may develop within the scientific community towards the researchers who engaged in that communication. This type of judgement highlights that even though there is general consensus regarding the characteristics of the superordinate group if a group member is perceived as damaging the outward perception of that superordinate group, then that individual is viewed negatively or poorly by their peers. Consequently, it triggers social comparison and leads to negative stereotypes and social identity threats.

There are long-term consequences related to prolonged exposure to social identity threat which can have detrimental effects on mental health, wellbeing and professional relations (Steele et al., 2002). This is seen in the data in this thesis when participants describe the negative consequences associated with certain types of communication and their feelings towards researchers who communicate in ways they feel challenge the integrity of science and, therefore, their social identity. The superordinate science group has the benefit of

contributing to identity management strategies whereby individuals are adopting strategies to cope with this social identity threat—specifically through the process of seeking social support from in-group members. By aligning themselves with this superordinate group and ensuring their behaviours align with the normative behaviours prescribed by the superordinate group, individuals are able to maintain the integrity of their social identity (Hogg & Abrams, 2007).

9.2.1.3 Role Conflict and Role Ambiguity. The implications of role ambiguity and role conflict in the communication of science are substantial, particularly in shaping researchers' engagement with science communication and advocacy. External pressures, such as funding requirements and evolving professional expectations, compel researchers to extend their communication beyond academic settings (Murunga et al., 2024). However, when these pressures conflict with researchers' conceptualisations of their professional roles, they may experience role ambiguity and role conflict. This has important consequences for individual researchers and the broader scientific community, influencing researchers' willingness to engage in public discourse and advocacy efforts.

The necessity to secure funding through advocacy, despite potential misalignment with researchers' professional values, suggests that advocacy may not always be voluntary but rather an obligation imposed by systemic constraints. This dynamic has implications for how researchers navigate their professional identities, as they must reconcile the tension between their commitment to scientific integrity and the pragmatic need to sustain their research. The perception of advocacy as an obligation rather than a choice may shape the ways in which researchers frame their engagement with science communication, potentially influencing how they present scientific findings to various audiences.

Time constraints further compound role conflict, as researchers must balance multiple professional responsibilities, limiting their capacity to engage in science communication

effectively. This limitation suggests that while researchers may recognise the societal value of public engagement, structural barriers within academia may prevent them from fulfilling this role to the extent they desire. Addressing these barriers may require institutional support mechanisms that acknowledge and accommodate the growing expectations placed on researchers to communicate their work beyond traditional academic spaces.

Discipline-specific norms also shape how researchers experience role conflict, as professional identities are cultivated within disciplinary frameworks (Beam et al., 2009; Burford, 2012; Ibarra, 1999; Stevens et al., 2008). While some researchers may find that their disciplinary norms align with expectations for public engagement, others may experience tension when interdisciplinary collaboration introduces competing perspectives on the role of advocacy in scientific communication. The increasing emphasis on interdisciplinary research may (Porter & Rafols, 2009; Xu et al., 2016), therefore, necessitate clearer institutional guidelines to help researchers navigate these complexities without compromising their professional integrity.

Beyond contending with their own personal inclinations and perceptions of their role within society as researchers, researchers are also positively and negatively influenced by discipline-specific considerations. This complexity may not be uniformly challenging for all researchers, as professional roles are shaped to a certain degree within each discipline during their formative and active years (Ashby et al., 2016; Hernandez et al., 2017; Hunter et al., 2007; Hunter & Cook, 2018; Price et al., 2021). Consequently, for many researchers, their ideologies around their place within advocacy may align closely with their disciplinary norms, alleviating any risk of conflict. However, there is a growing emphasis on interdisciplinary collaboration and engagement (Porter & Rafols, 2009; Xu et al., 2016), and these divergent perspectives may clash, creating internal and external pressures and challenges for researchers.

9.2.1.3.1 Professional Norms as a Mitigating Factor. The findings of this research underscore the critical role that professional norms play in managing and mitigating role conflict and role ambiguity among researchers. Participants identified norms such as honesty, objectivity and rigour as essential across all forms of science communication, with these standards serving to preserve the integrity of scientific discourse. Professional norms provide a standardised framework of expectations and behaviours (Andersen, 2009), helping researchers navigate their roles in the context of science communication by reducing ambiguity and clarifying their responsibilities. However, the commercialisation and politicisation of science are gradually shifting these professional norms, particularly with respect to the expectations placed on researchers when they communicate their findings (Schiele et al., 2012). These shifts are largely driven by institutional mandates and funding agency requirements, which increasingly emphasise the need to disseminate research outcomes to wider audiences (Schiele et al., 2012). A growing perception exists that researchers have an obligation to communicate their findings if their work is publicly funded (Metcalfe & Gascoigne, 2012). This shift also extends to the push for open-access publications.

These evolving norms are particularly evident in discussions surrounding advocacy-based communication. Health researchers, for example, appear more inclined to advocate based on their findings, likely owing to the immediate public relevance of their work. In contrast, environmental researchers may exhibit greater hesitancy, as the nature of environmental issues tends to be more distal and may invite public backlash. This distinction reflects the broader societal shift towards applied science (Bednarek & Tseng, 2022; Murunga et al., 2024), where health research often produces tangible, practical outcomes, while environmental research may offer less direct or immediate benefits. Consequently, advocacy-based communication in health research has more clearly defined professional

norms, given the immediate societal impact. Conversely, the professional norms guiding environmental researchers have not evolved at the same pace as societal expectations, which may contribute to the role conflict and role ambiguity these researchers experience. Therefore, disciplinary contexts significantly shape researchers' comfort with advocacy-focused communication.

9.3 Practical Implications

Beyond the theoretical implications, this research project offers important practical implications, particularly in the context of the evolving role of science within society, as described by participants. Over the past century, science has undergone shifts across various dimensions (Metcalfe & Gascoigne, 2012, 2020), with this study specifically highlighting changes in the role of science in policymaking, research funding mechanisms and the organisational structures of universities. The findings suggest a move away from the traditional role of universities as primarily educational institutions towards a more corporate model that prioritises economic and capitalist objectives. This shift reflects changing societal expectations of researchers, who are increasingly pressured to focus on applied science with direct, real-world applications rather than purely theoretical or exploratory work (Bednarek & Tseng, 2022; Murunga et al., 2024).

As governments prioritise applied research, researchers are driven to secure funding not only to advance their careers but also to maintain their positions, leading to a growing reliance on government grants (Murunga et al., 2024). This dynamic has significant implications for the direction of scientific research, as the projects pursued are increasingly shaped by government funding decisions, which are influenced by national priorities, policies, strategic initiatives, stakeholder input, budget allocations and expected societal impact. As a result, the trajectory of research in Australia is increasingly dictated by governmental agendas rather than the scientific community itself. Moreover, the shifting

expectations regarding researchers' roles in science communication—particularly the integration of advocacy—indicate that traditional conceptualisations of these roles have not kept pace with the rapid changes in communication practices. These evolving expectations raise numerous practical challenges, including the impact of funding cycles, the pressures of the 'publish or perish' model and concerns about safety and trust in science. Each of these issues will be explored further in the following sections.

9.3.1 Funding Cycle Implications for Communication

Performance metrics and funding cycles significantly shape researchers' goals, influencing both the research they pursue and how they communicate their findings. This creates a bias toward communicating research tied to funded projects, which are often dictated by government and funding agency priorities. As researchers face time constraints and competing obligations, they may prioritise communicating only on topics aligned with their funding, neglecting other important scientific advancements. Additionally, as much of the funding is linked to politically charged topics, researchers may face increased backlash for communicating such work. The absence of institutional support or training to mitigate these risks further amplifies the negative consequences of engaging in science communication.

The findings also reveal that researchers are driven by the need to secure funding to continue work they consider personally and professionally meaningful. Participants in this study emphasised their strong desire to make a societal impact, but to do so, they must often align their research with funding opportunities. When their preferred research no longer attracts funding, they are forced to shift focus to projects that will. This shift diminishes the pursuit of pure science and redirects scientific inquiry based on economic and political interests rather than researchers' intellectual autonomy. Such redirection threatens innovation, limits our understanding of the natural world, and risks fostering cognitive

inflexibility among researchers as their work becomes confined to projects that secure funding rather than exploring broader scientific questions.

9.3.2 Publish or Perish Implications for Communication

The ‘publish or perish’ mentality in academia has implications for science communication. The emphasis on quantity over quality incentivises researchers to publish frequently, potentially compromising the rigour of their work. This mentality also encourages a focus on popular or ‘safe’ topics that can be published quickly, at the expense of pursuing innovative or high-risk ideas that could yield major breakthroughs. This competitive pressure may hinder collaboration and knowledge-sharing, as researchers prioritise individual achievements over collective scientific progress, limiting the broader societal benefits of science. Early-career and less privileged researchers may be disproportionately affected by these demands, struggling to meet publication targets compared with established colleagues, exacerbating inequality in academic advancement.

Furthermore, the constant pressure to publish can lead to mental health issues, including stress, anxiety and burnout. Although not explicitly addressed in this research, there is a risk that the pressure to publish could contribute to unethical practices, such as data manipulation or plagiarism, and discourage essential replication studies, which are vital for validating scientific results (Grimes et al., 2018; Mancoridis et al., 2024; Miller et al., 2011; Van Dalen & Henkens, 2012). The pressure to consistently produce research outputs heightens tensions and creates competing priorities for researchers (Hangel & Schmidt-Pfister, 2017). The focus on publishing, driven by institutional pressures, compels researchers to publish continuously to secure funding and advance their careers.

While publishing is essential for scientific progress, the ‘publish or perish’ culture can create issues. Focusing on funding cycles and performance metrics divides researchers’ attention, making it difficult to balance institutional demands with their professional values.

This balancing act can lead to role ambiguity or conflict, particularly when researchers feel obligated to engage in advocacy to secure funding, even when it conflicts with their preference for objective, fact-based communication. These tensions can result in communication practices that challenge researchers' professional identities.

9.3.3 Safety Concerns and Communication

The current project clearly demonstrates that safety implications associated with communication have far-reaching and damaging implications. The lack of a discussion in the literature on this particular issue is highly concerning and suggests this to be an invisible issue with which the researchers must contend. Most often discussed in relation to advocacy-type communication, participants reported threats to life and personal safety, which may be levelled towards researchers as a result of their communication. This clearly demonstrates the need for support systems, reporting mechanisms and effective training to ensure researchers' physical and psychological safety when engaging in communication.

However, psychological safety was not limited to personal threats alone but was also expressed through the emotional toll that advocacy takes—specifically, dedicating one's career to effecting societal change, only to witness persistent challenges such as the ongoing decline of a species despite extensive efforts and lifelong dedication to its conservation. With a researcher's professional identity often being the most salient and important identity in their life (Adams et al., 2006; Hogg & Terry, 2001), this type of emotional toll can have far-reaching implications for the perceived value of their life's endeavours, their self-worth, self-esteem and, therefore, their identity and wellbeing.

9.3.4 Trust in Science

The current research clearly demonstrates implications for the public's trust in science as a function of researchers' engagement in science communication. Specifically, science communication will only become more pivotal for society with the rise of misinformation,

fake news, and deepfakes. Therefore, researchers are going to continually be relied upon to be the arbiters of truth and be the justification for policy decisions. Therefore, researchers engaging in science communication play a crucial role in shaping public trust in scientific research.

Effective science communication enhances transparency and fosters a more informed public by bridging the gap between scientific communities and the public, potentially counteracting misinformation (Kelly et al., 2020, Murunga et al., 2022, Nettlefold & Pecl, 2022). This proactive engagement improves public understanding and builds credibility and trust in scientific institutions (Bao et al., 2023). Moreover, when researchers openly address uncertainties and limitations of scientific findings, the integrity of the scientific process is reinforced, which is essential for maintaining public confidence (Turnhout et al., 2013). Researchers' involvement in science communication is integral to sustaining a robust relationship between the scientific community and the public, ultimately supporting informed decision-making and policy development (Murunga et al., 2024). Therefore, researchers must be aware of the different forms of science communication, the implications of engagement in these different forms of communication, and their personal preferences and comfort levels in engaging in these different forms of communication. Leading to better awareness of the impact of the communication of science in relation to the public's trust in science and the public and policymakers' views on the credibility of the researchers and the scientific community more broadly.

9.4 Science-Communication, Science-Advocacy Continuum

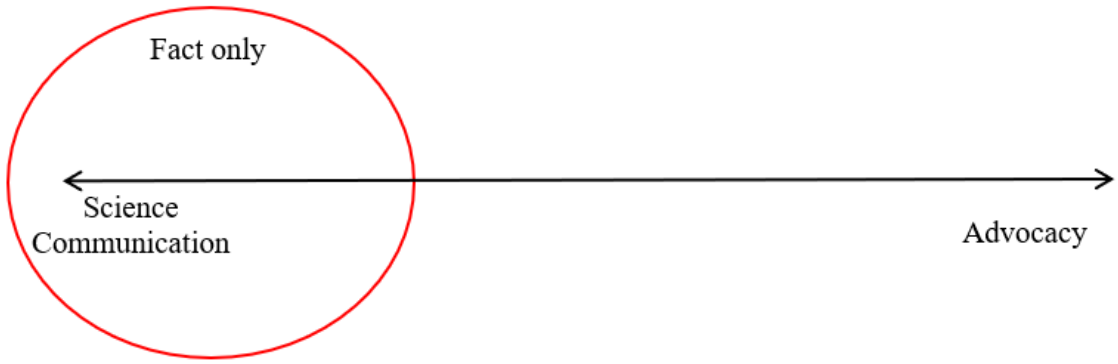
Finally, the culmination of this research has informed the proposal of a new theoretical model explaining the conceptualisation of science communication and advocacy by researchers. Specifically, this model seeks to describe how researchers' choose to engage in science communication when considering their professional identities, professional norms,

and personality idiosyncrasies. This model is adapted from Donner's (2014) science–advocacy continuum and is outlined below. It begins by discussing how participants conceptualised science communication, differentiating between formal and informal science communication. It then progresses along the science–advocacy continuum proposed by Donner (2014) offering adaptations to this model conversant with the findings of this research.

Broadly speaking, participants viewed science communication as an obligation that was embedded within their professional roles as researchers. Participants viewed their professional identities and roles as researchers as being directed and governed by the scientific method and grounded in science fundamentals. Having their identity shaped by the scientific method influenced how participants viewed engaging in science communication. For instance, engaging in fact-based communication was thought to be a key position from which researchers should be engaging in the communication of science. This finding highlights how strongly the role of a researcher (being an impartial arbiter of truth) was embedded within participants' professional identity. Specifically, participants viewed science communication as part of the scientific method and identified that journal articles are the primary form of science communication in which researchers should engage. Consequently, participants viewed science communication as fact-based communication (Figure 9.2). Fact-based communication, as described by participants, supports part of the science–advocacy continuum (Donner, 2014). More specifically, these findings support the science-dominant end of the continuum where engagement from this position focuses on communication that is based on objective judgements. This type of science communication is distinctly different from advocacy-type communication because it is viewed as impartial communication, without an agenda or pushing for outcomes and is grounded in fact-based information.

Figure 9.2

Participants View of Science Communication as Only Fact-Based Communication

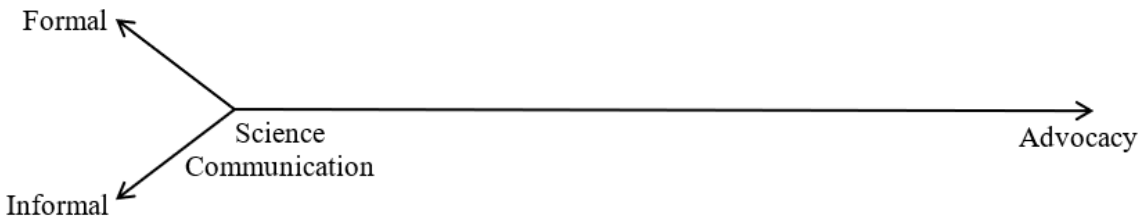


Note: Adapted from Donner (2014)

However, contrary to Donner's (2014) science–advocacy continuum, participants identified that modern science communication could be conceptualised as taking both a formal and informal position (Figure 9.3). While science communication was clearly a part of the scientific process and a role of researchers within society, the modern form of science communication (the distinction between formal and informal communication) was not something that was inherently clear or well understood within the profession. This suggests that the conceptualisation of researchers' roles within science communication has not kept pace with the speed at which science communication has changed over the last 30 years. This indicates that perhaps this element of researchers' professional identities may not be something that is explicitly acquired as a part of the formal learning process (like other elements of their professional identity) but is more of a normative behaviour with an ill-defined scope and expectations. This is further illustrated when researchers describe that not all researchers need to be science communicators and that researchers should instead be working to their strengths.

Figure 9.3

Participants View of Science Communication as Consisting of Two Distinct Types, Formal and Informal

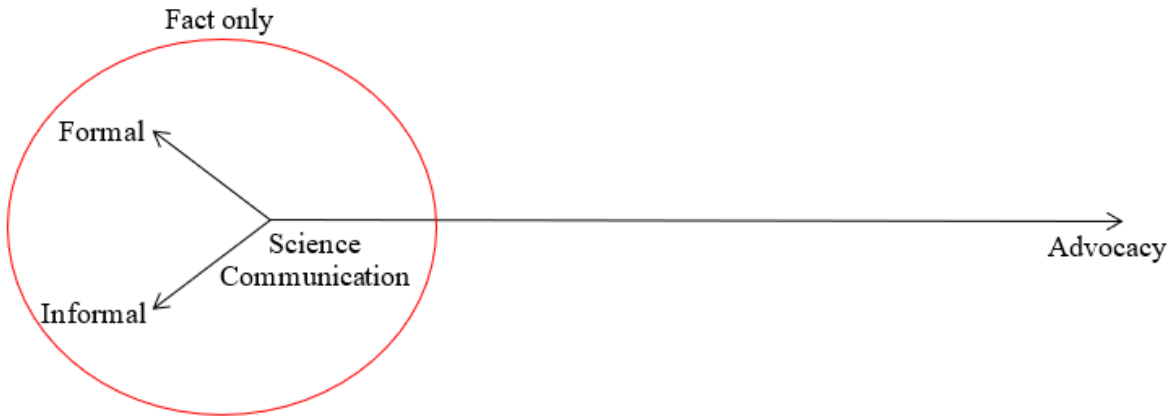


Note: Adapted from Donner (2014)

While the conceptualisation of participants' positions in relation to science communication seems relatively well understood, there was much less clarity regarding researchers' engagement in advocacy. When conceptualising how researchers viewed advocacy in relation to science communication, participant responses support the notion of science communication and advocacy as falling on a continuum, which is consistent with the model proposed by Donner (2014). However, participants' views around what advocacy was or the position of advocacy along this continuum were at times contradictory. Interestingly, some described researchers' engagement in advocacy as being focused on or centred around fact-based communication, with this type of communication more reminiscent of 'true' science communication rather than a traditional definition of advocacy (Figure 9.4).

Figure 9.4

Participants View of Advocacy as Consisting of Fact-Based Communication

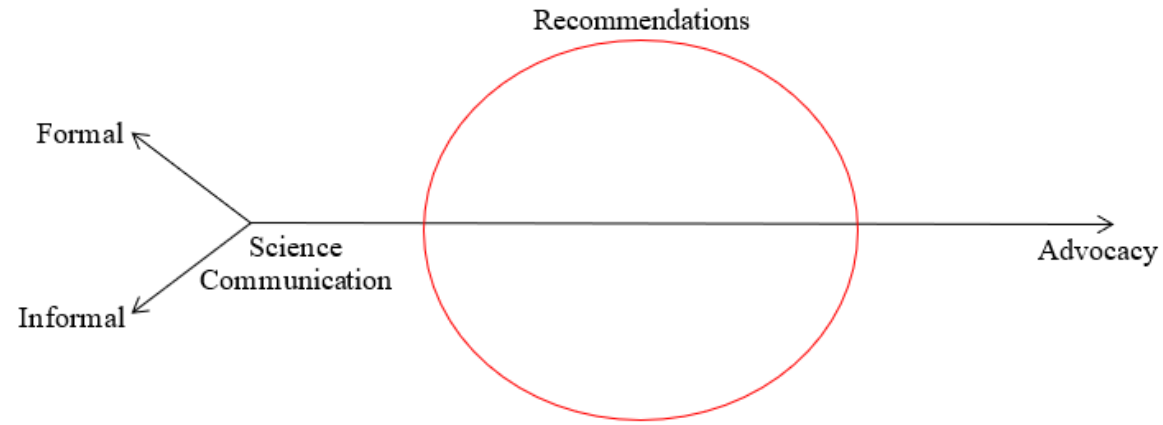


Note: Adapted from Donner (2014)

However, researchers' engagement in advocacy was also described by others as being focused on providing recommendations based on their fact-based communication. This perspective suggests a further shift along the science–advocacy continuum towards the advocacy end (Figure 9.5). This suggests that there is less clarity around what exactly researchers' roles are within advocacy, with this desire to provide recommendations based on facts seeming to blur the line between science communication and advocacy. Perhaps it indicates that, at least in this case, science communication and advocacy are not distinctly different operationally.

Figure 9.5

Participants View of Advocacy as Consisting of Providing Recommendations



Note: Adapted from Donner (2014)

Advocacy by researchers was also at times described as ‘researchers explaining what should be done’ based on scientific facts. This aligns with what would normally be considered advocacy or ‘true’ advocacy by participants (Figure 9.6). There is a spectrum of viewpoints amongst researchers regarding the nature of advocacy that is conducted by researchers, ranging from perceiving it as synonymous with science communication to conceptualising it as genuine advocacy. This diversity largely aligns with Stephen Donner’s concept of the science–advocacy continuum, indicating that researchers indeed situate themselves along this continuum based on their perspectives and practices.

Figure 9.6

Participants View of Advocacy as Consisting of Stating what Should Happen Based on Science



Note: Adapted from Donner (2014)

The findings of this study provide a framework for understanding the distinction between science communication and advocacy, revealing areas of overlap. Advocacy was perceived by some participants as a distinct role, by others as a subset of science communication. In certain cases, science communication was seen to evolve into advocacy naturally. Additionally, the perception of advocacy varied across disciplines, further blurring the lines between the two. Interestingly, participants identified the scientific establishment as having a role in advocacy rather than the researchers having a specific role as an advocate.

This suggests that there may be qualitative differences between advocating for your own science and advocating for science in general, with the potential for this diversity to be viewed in a different light by other in-group members, potentially leading to less severe consequences to self-esteem and role conflict. Implying that advocacy exceeds the straightforward stance of being solely confined to ‘science advocacy’ (Figure 9.7). Rather, it encompasses advocacy that extends beyond scientific domains, leveraging the power and

influence ascribed to researchers by the perceived value of their position within society. Such engagement holds implications for both the researcher's professional identity and the broader spectrum of science communication activities that researchers might undertake—for instance, communicating in a way that is tangential to their specific research area and may, at times, be conceptualised as a form of self-promotion. This is often viewed negatively, indicating that there may be an element of judgement associated with researchers engaging in advocacy that is perceived as self-interested. This sentiment was not surprising. As discussed in previous chapters, participants emphasised the importance of researchers conducting their work and communicating scientific knowledge in an altruistic way that benefits society.

Figure 9.7

Participants View of Science Communication as Consisting of Two Distinct Types—Formal and Informal—and Advocacy as Consisting of Science Advocacy and Personal Advocacy



Note: Adapted from Donner (2014)

These varying perspectives on researchers' engagement in advocacy support Stephen Donner's concept of a science–advocacy continuum and also, to some extent, resonate with the honest broker quadripartite model (Pielke, 2007), which can be superimposed onto the science-advocacy continuum. This overlay is evident as each of the four categories within the quadripartite model can represent distinct positions along the continuum: from the pure scientist at the science communication end, to the issue advocate at the advocacy end.

However, the current research differs from these models because these positions are not stable over time. According to Pielke (2007) and Donner (2014), every instance of communication necessitates a reassessment of how researchers choose to engage in science communication or advocacy. However, the present study suggests that researchers locate themselves along the science/advocacy continuum where they feel most comfortable, based on their perceptions of science's societal role and the disciplinary norms to which they adhere. Moreover, researchers may shift along this continuum owing to various facilitators and barriers potentially leading to internal and professional challenges. Overarchingly, the role conflict and role ambiguity that researchers feel may explain how and why each researcher chooses to engage in science communication, which has been discussed in the preceding sections.

9.5 Future Research and Recommendations

Further research is needed in several key areas. First, validating the current study's findings using larger and more diverse samples: These validation studies should include testing the utility of the science communication–science advocacy model and the SIT-SCT professional identity development model within a broader context. Specifically, it is recommended that a broader sample size is used that includes a more diverse range of participants (gender, age and career stage) who are employed in different industries (private research organisations, governments and NGOs) and that draw from more diverse disciplines (e.g. social science, medicine).

Additionally, further studies should investigate the impacts of researchers' professional identity development in non-Western contexts, and the implications this has for the communication of science—specifically, the social, cultural and institutional factors shaping professional identity in these regions may differ significantly from those in Western

contexts. Professional identity is influenced by local norms, values, educational systems and the broader societal expectations placed on researchers.

In non-Western contexts, these influences might lead to different conceptualisations of what it means to be a researcher, as well as varying expectations regarding the roles and responsibilities of researchers in science communication. Additionally, understanding how professional identities develop in non-Western contexts could provide valuable insights into the diverse ways researchers approach science communication. Exploring these differences could help to expand current theories of professional identity development and science communication, making them more globally relevant and inclusive. It could also have practical implications for designing science communication strategies that are culturally sensitive and tailored to specific regional or institutional contexts. Moreover, such research might reveal how non-Western researchers navigate challenges like role conflict, role ambiguity and external pressures in ways distinct from their Western counterparts, offering alternative models of science communication that could enrich global scientific discourse.

Further studies would also benefit from considering researchers' perception of their roles and responsibilities in science communication considering artificial intelligence, misinformation and disinformation. As AI becomes increasingly integrated into scientific practices, whether through data analysis, automated reporting or content dissemination, researchers may need to adapt their communication strategies to account for AI-driven tools' which have both ethical and practical implications. For instance, AI can facilitate the rapid spread of information and generate misleading or inaccurate representations of research findings (Saheb et al., 2024). This raises important questions about the extent to which researchers should be involved in overseeing and validating AI-generated communications to ensure scientific accuracy and integrity.

Moreover, the spread of misinformation and disinformation presents new challenges for researchers in how they convey their findings to the public. In an era where false information can rapidly proliferate across social media and other digital platforms, researchers may feel a heightened responsibility to act as custodians of truth, correcting misinterpretations or combatting intentionally misleading narratives. This expanded role can create additional pressures and ethical dilemmas, especially when addressing politically or socially sensitive issues, such as climate change, vaccines or public health.

Investigating how researchers perceive their roles amidst these evolving dynamics could reveal important shifts in professional identity and communication practices. For instance, researchers may increasingly see themselves as communicators of scientific knowledge and as active participants in a broader effort to counteract misinformation. They may need to balance this responsibility with their traditional focus on objectivity and rigour, potentially leading to role conflict or role ambiguity. Furthermore, researchers might have differing views on the appropriateness of using AI tools for public engagement, especially if such tools raise concerns about depersonalisation or the loss of control over how their work is represented.

By exploring these issues, further studies could provide insights into how the scientific community navigates the complex landscape of AI, misinformation, and disinformation and how these factors reshape the norms, responsibilities and expectations surrounding science communication. Such research could also inform strategies for effectively integrating AI into communication practices and developing more robust frameworks to counteract the spread of misinformation, ensuring that science remains a trusted source of knowledge in an increasingly digital and polarised world. Other recommendations include understanding the public’s perception of researchers who engage in

different forms of science communication and whether communicating science that has either proximal or distal consequences to the researcher's core expertise affects these perceptions.

Several recommendations are suggested based on this project. It is often suggested, logically, that further training is needed for researchers in relation to science communication, specifically designed to provide assistance to communicate a specific message in a specific context (Murunga et al., 2024). This training does not provide any education relating to the emotional impact of engagement in communication, nor does it speak to protecting researchers working within this communication space. Therefore, it is recommended that researchers be offered effective training to ensure their psychological and physical safety when communicating. Furthermore, appropriate support systems and reporting mechanisms must be in place to offer assistance should researchers feel that their emotional, psychological or personal safety is at risk.

The way society conceptualises the communication of science has not necessarily kept pace with the rapid changes in the way people access information. Therefore, a recommendation of this research is to redefine and clarify the operationalisation of research impact. There needs to be more clarity around performance metrics and career progression—specifically, a better understanding of how these are operationalised and measured and how these are affected based on disciplinary differences. There needs to be a movement away from the publish or perish model and a re-focus towards quality over quantity. Addressing these issues requires promoting a balanced approach that values both the quality and impact of research outcomes, supports open science practices, encourages collaboration and recognises diverse contributions to scientific advancement beyond traditional metrics of publication quantity.

Furthermore, there needs to be an acknowledgement that not every researcher is required to participate in science communication and recognise the value of their

contributions outside of communicating science. Therefore, it is not simply about training but understanding that researchers have different strengths and value alignment to identity which has implications towards the authenticity of communication, trust in science and trust in researchers. Addressing these recommendations requires institutional support, changes in incentive structures, improved training programs and a cultural shift within the scientific community to recognise the importance of science communication to increase the public's trust in science and the credibility of science among policymakers and the public.

9.6 Limitations

It is important to note that there were several limitations to this project. One major limitation of the current project is the sample used. Specifically, there are issues with generalisability owing to the small sample size and the geographic location from which participants were drawn. It is acknowledged that participants were not drawn from all science industries within Australia (no researchers from privately funded industries were sampled), nor were the samples from some industries (e.g. governments and NGOs) substantial enough to draw accurate conclusions for all researchers. Consequently, the participants in this sample are not representative of the broader scientific community within Australia or the scientific community globally.

Owing to the recruitment method, there is the risk of self-selection bias, with those who participated in this study representing a subset of the population who were highly motivated to participate. Additionally, there is the potential risk of researcher bias in interpreting the results, as the principal investigator's immediate family works within the STEM research fields. However, this project employed extensive 'critical friend' meetings to check for bias in interpretation, and the principal investigator regularly and consistently reflected on her lived experience and the implications of bias in her interpretation. By

keeping this at the front of her mind during data collection and analysis, it is hoped that researcher bias was kept to a minimum.

Indeed, ‘critical friend’ meetings did not identify any instances of bias in the principal investigator's interpretation. While qualitative methods were best suited to the aims of this project, additional studies are needed to triangulate the findings of this project and strengthen the validity and reliability of the findings. Furthermore, quantitative methods are required to confirm both the proposed theoretical models (SIT-SCT professional identity development model and the science-communication, science-advocacy model). Therefore, research should be undertaken to achieve this.

As this project relied on self-reported data, it is possible that some psychological experiences were not captured, which may have been intentionally or unintentionally hidden by participants. Specifically, participants may have concealed information from the researcher in an attempt to present a favourable image of themselves (social desirability bias) or because they did not trust the researcher sufficiently to divulge such information. However, this research aimed not to report on the rates of certain behaviours but rather to explore why some researchers chose to engage in some communication styles over others. Discussion of sensitive topics such as safety concerns demonstrates a level of trust gained by the researcher during the interviews. Lastly, the fast-moving and ever-evolving nature of science communication meant that elements relevant in today’s contextual landscape were not applicable at the time of data collection. For example, there was no opportunity to explore the impact and implications of artificial intelligence with participants at the time of data collection because this area had not yet developed to the point it has now.

9.7 Conclusion

This research project has shown that when researchers consider engaging in the communication of science, the question ‘Should I engage in advocacy?’ is a complex one that

is influenced by several important considerations. These considerations include the conceptualisation of professional identity and role, discipline-specific norms, societal expectations, the changing nature of science, personal safety and personal preferences. More broadly, this research project has demonstrated that engagement in science communication can take many forms and may have different consequences depending on who you are communicating with and what you are communicating. Consequently, it is important to engage in communication from a position that aligns with the values of researchers and the researcher's individual view of science's place within society.

This research project addressed several gaps in the current knowledge. It explored how researchers conceptualise different forms of science communication, how advocacy is viewed within the context of science communication and how identification with the researcher profession influences choices to engage in the communication of science. Overall, the findings make valuable contributions to various areas of psychological theory and provide evidence for a new model of science communication. While the engagement in science communication by researchers is imperative for the future progression of society, ineffectual communication can have far-reaching implications.

This research project shows that while this is a complex problem, if the researchers themselves are not accounted for when considering the communication of science, the credibility of science and general trust in scientific findings are at risk, along with the mental health and wellbeing of the researchers doing the science.

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Appendix A

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Appendix B

JAMES COOK UNIVERSITY
AUSTRALIA

INFORMATION SHEET

PROJECT TITLE: An investigation into the development of researchers' professional identities

You are invited to take part in a research project that aims to understand how researchers think about advocacy and how they decide the extent to which they publically comment about science. You will be asked questions regarding how you identify yourself as a researcher, how you view your professional role, your attitudes towards science communication and advocacy, along with demographic questions. The findings of this study will shed light on how researchers view their professional roles. The study is being conducted by Alison Sheaves from the Department of Psychology, College of Healthcare Science, James Cook University and will contribute to my Doctor of Philosophy research degree at James Cook University.

If you agree to be involved in the study, you will be invited to be interviewed. The interview, with your consent, will be audio-taped, and should only take approximately 1 hour of your time. The interview will be conducted at the College of Healthcare sciences at James Cook University, or a venue of your choice.

Taking part in this study is completely voluntary and you can stop taking part in the study at any time without explanation or prejudice. The data from the project will contribute towards my Doctor of Philosophy thesis and may be published in peer-reviewed journals. You will not be identified in any way in these publications. Your response and contact details will be strictly confidential.

If you are aware of others who might be interested in participating in this study, can you please pass on this information sheet to them so they may contact me to volunteer for the study?

If you have any questions about the study, please contact Alison Sheaves and/or Dr Anne Swinbourne.

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If you have any concerns regarding the ethical conduct of the study, please contact:
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Appendix C

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