“I’m Cited, Therefore I Am!”: How Publishing Constructs the Scientific Identity

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Introduction

The value of an academic scientist is largely based on his or her publication record. It is through publications that academic scientists share their ideas and research, peer review marks the research as credible, and citations illustrate the impact of the research and in turn determine its value. Publications are required to sustain or further one's scientific career so much that the phrase "publish or perish" was coined to describe the pressure that academics are under. Where did this value of publication begin? And how does publishing affect the work of academic scientists and how they view themselves?

Toward the middle of the 20th century scientific publishing became emphasised in academia. In 1942 university administrator Logan Wilson noted when writing on the academic profession that there was "emphasis on 'quantity rather than quality' in publication" and there was the "legend" of "publish or perish credo within the ranks" of academia (Wilson 1942, p. 63, 197). The emphasis on quantity increased with impact factor first being explored in 1955 and the publication of the Science Citation Index in 1961 (Garfield 1955; Garfield and Sher 1963). Since the 1980's universities and their researchers have increasingly been assessed for performance, quality, and efficiency in order to determine value for money (Shore and Wright 2000; Audit Commission 1984). Academic scientists or faculty members typically fulfill various roles in teaching, research, and service for an institution. However, for the purposes of hiring, faculty assessment, and promotion, research productivity in the form of peer reviewed publications is weighed most heavily (Skolnik 2000). An academic's publication record informs their scholarly reputation and plays a crucial role in their career advancement (Skolnik 2000; Long and Fox 1995; Committee on Maximizing the Potential of Women in Academic Science and Engineering

2007). As a result the phrase “publish or perish” is one of the most enduring expressions in academia.

With the rise of audit culture in higher education it has been argued that academic value is increasingly becoming "monetised" and as a result academic values are being transformed (Burrows 2012). Auditing technologies not only evaluate but determine quality, and the most effective auditing technologies transform the way people perceive themselves and their work (Shore and Wright 2000). Peer reviewed publications and citations are auditable criteria that are used to asses an academic scientist’s productivity and to a great extent their worth to an institution. But how does the pervasive publish or perish narrative and the audit culture of academia impact how academics view or evaluate themselves? As Grey and Sinclair express it:

> We write because it has become our way of being, our way of reassuring ourselves about our own significance. I’m cited, therefore I am! Actually, the reality is even more dismal than that since the bulk of work in the field is scarcely cited, perhaps scarcely read, at all. Still, there is a sense in which our writing makes us real to ourselves, or, rather, makes us real in the mirror which is our colleagues’ view of us. (Grey and Sinclair 2006, p. 448)

If other academics share the same view as Grey and Sinclair it would appear that academics also validate themselves through their publications and so perhaps audit technologies have successfully transformed how individual academics perceive themselves and relate to their work. In order to investigate this possibility this dissertation will explore how publishing practices affect the identity of academic scientists, what role narratives and audit culture may play in constructing this identity, and conversely how these identities influence the publishing decisions of academic scientists.

Throughout this dissertation I will argue that the scientific self, or the identity of a scientist, is constructed from the values of scientific culture, training, experiences of scientists,

and most importantly publishing research. For Lorraine Daston and Peter Galison a “self must be practised” or performed (2007, p. 199). This notion of the scientific self arises out of Michel Foucault’s technologies of the self, which "permit individuals to effect by their own means or with the help of others a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality" (Foucault 1988; p. 18). Technologies of the self are practices in which subjects police their selves within society, form themselves within and through systems of power. By studying audit culture we can gain further understanding of how the management of academics is made possible by audit discourses and how this contributes to the shaping of scientific selves. The practices that form the scientific self can include maintaining lab notebooks, being trained in scientific observation, developing hypotheses, and publishing their research (Daston and Galison 2007). For Foucault, as for Daston and Galison, these practices not only express the self, but “forge and constitute it” (Daston and Galison 2007, p. 199). These practices, particularly for a trainee scientist, develop the scientific identity and a sort of calibration continues throughout their career by continually performing and constructing the academic scientific self through these cultural practices. By practicing or performing the values of scientific culture, such as experimentation or publishing, academic scientists routinely practice and construct their self. The narratives that academic scientists use to narrate their work life can illuminate the present dynamics of academic science culture and how the identities of academic scientists are constructed. These narratives aren't simply descriptions of work life, but are in themselves constructive and play a vital role in how scientists learn about scientific culture and their role as scientists, the narratives they learn to tell and share, view themselves, and

narrate their identities and work. The publish or perish narrative is a particularly interesting narrative, because it is pervasive within academic science culture and as a result it influences all other practices that scientists perform: what they choose to research, how they conduct experiments, what they write, and how they style this writing.

The historian of science Steven Shapin argues that the identity of the scientist was "radically unstable" at the beginning of the twentieth century (2008). Science was originally pursued by amateurs out of curiosity and very few natural philosophers or scientists were employed as researchers. However, by the mid-twentieth century "scientist" was evolving to a vocation (Shapin 2008). This shift from science being similar to a hobby to becoming established as a career created this instability. This instability left the scientific identity vulnerable to influence and changes, particularly to conforming to new definitions of what science as a career entailed. It was also in this period, toward the middle of the century that publishing emerged as a core marker of the scientific career (Shapin 2008; Mills 1942). An interesting anecdotal example comes from a book on scientific careers written in 1950. In the preface to the book the author noted that he thought that older scientists would not see the point in the publication as scientific research was done 'for the love of it' (Shapin 2008, p. 105). This example illustrates not only the shifting of scientist from a calling to a vocation, but also the emergence of scientific publications as key elements in the scientific career. Publication was now the result of scientific research and this shift was reflected in the developing identity of the academic scientist.

A notable work on scientific identities is Kerry Holden's study on the use of the "golden age" myth in the collective memory of scientists (2014). Myths are narratives used to support the values of a society (Barthes 1972; Levi-Strauss 1978). For the purposes of this discussion myths

are most often seen as narratives that cultivate the shared values among individual scientists within a larger scientific discipline or community, by supporting an idealised concept of what science is or who scientists are. Holden interviewed 45 scientists working in two university research centres in London. Her methodology was developed by anthropological studies to examine how employees narrate their identities and work life. The majority of the scientists that Holden interviewed described science moving from a "golden age" to an economically driven age. The golden age is characterised by intellectual freedom, ample time to think and tinker with new ideas or experiments, and a calling to do science, but it doesn't inhabit a specific time in history (2014). Rather than necessarily corresponding to a distinct point in the past, according to Holden, the holden age myth plays a performative role in the self understanding of the interviewed scientists by underwriting the scientific identity and differentiating between science and the procedures that commercialise science. One of the participants in Holden's study was Joyce, a professor who heads a London university's entire biomedical science faculty. He discussed the pressures academic scientists face and lamented the loss of ample time:

> Under the pressures [researchers] are under now … How many papers this year? In the right journals? It's pressure, pressure, pressure and a certain amount of pressure is good but science comes from a depth, a thought, a stillness, and an ability to think. It does not come from being poked in every direction. (Holden 2014, p. 11)

For Joyce the ample time to think is critical to scientific learning and developing the practices of a scientist. Joyce and other participants in the study expressed concerns that the "cognitive facets such as curiosity, passion, and commitment are disappearing" as a result of the pressures to publish and obtain funding (Holden 2014, p. 11). At first it would appear that disillusionment resulting from this loss would cause academics to flee academia, and perhaps

some do, but Holden's analysis shows that the golden age myth helps scientists to clearly demarcate between the requirements of a job and science, enabling the preservation of their ideals of science. Most interestingly, the myth provides a motivation for researchers to give their labour to academic science, for which academia so heavily relies on, and guarantees their commitment to the profession. Holden notes that the "'golden age' myth is a resource for constructing a scientific identity that motivations people to apply their labour to academic science without challenging the conditions in which they work" (2014, p. 19).

This dissertation focuses on narratives that academic scientists use to describe their work life rather than the myths Holden used to investigate the self-understanding of scientists. However, Holden's methods and conclusions are useful in relation to this dissertation. Holden found that the golden age myth provided the motivation for researchers to give their labour to academic science, which often comes in the form of research and publications. Within the academic science culture the golden myths exists alongside and interacts with other myths and narratives, including the publish or perish narrative that this dissertation is most concerned with. This dissertation will address how audit culture in higher education is transforming the identities of academic scientists and influencing how they determine their self worth based upon auditable criteria, particularly with peer reviewed publications. I will first discuss the history of audit culture in academia with particular focus on higher education in the United Kingdom in order to establish the current emphasis on metrics in academia. I then present the methodology, which is focused on interviews with academic scientists. I will then analyse the interviews, which will enable me to define the academic scientist and show that publishing constructs the scientific identity for academic scientists. I then move on to a discussion of how metrics have impacted the

publishing practices of academic scientists and how audit culture has shaped the values in academic science. The conclusion addresses how the publish or perish narrative ultimately represents a greater loss than losing a university position.

Auditing Academics

The following section discusses the presence and impact of audit culture in academia. It's important to overview the role audit culture has had in shaping the procedures in higher education, because as I will show audit culture has not only influenced the way academics are evaluated, but it also has impacted the way they conduct their work, how they view themselves, and how the scientific identity is constructed. Academics in the United Kingdom have reported feeling exhausted, stressed, and anxious as a result of various pressures within the academy, including the pressure to publish and the metrics surrounding publication (Gill 2010; Burrows 2012). Many participants in my study also referenced the auditing in higher education, mostly notably the Research Excellence Framework (REF), which is a system for assessing the quality of research in the United Kingdom (Research Excellence Framework 2014). The REF was first introduced by the Higher Education Funding Council for England in June 2007 to replace the Research Assessment Exercise (RAE). The RAE previously was done every five years since 1986 on behalf of the four higher education funding councils in the United Kingdom to evaluate the quality of research on a four point quality scale (Research Assessment Exercise 2008). While the RAE was developed to assess research in the United Kingdom, the RAE was met with criticism by the University and College Union for its negative effects:

> The RAE has had a disastrous impact on the UK higher education system, leading to the closure of departments with strong research profiles and healthy student recruitment. It has been responsible for job losses, discriminatory practices, widespread demoralisation

> of staff, the narrowing of research opportunities through the over-concentration of funding and the undermining of the relationship between teaching and research. (University and College Union 2008, par. 3)

An official report, *Review of Research Assessment*, recommended changes to the RAE that reflected this criticism (Roberts 2003). The 2014 REF was the first REF assessment completed and covers the period of 2008-2013. REF submissions are judged for overall quality on a four star system that ranks submissions as world leading, internationally excellent, recognised internationally, and recognised nationally (Research Excellence Framework 2014). Full-time staff researchers who were required to participate in the REF submitted four items of published output, such as books and published articles, that were then evaluated. The requirement of only four submissions appears to focus on quality over quantity and allows for the REF panels to efficiently evaluate these research outputs. However, this requirement of the REF has met with some criticism since there is no difference of research value between a book and an article (Sayer 2014). For some researchers this has been interpreted as discouraging long term projects and the time investment that innovation requires (Wright 2014).

The REF as an auditing system informs the funding for higher education institutions in the United Kingdom, provides benchmarks for establishing institutional reputation, and "provides accountability" for public funds (Research Excellence Framework 2014). Throughout the 1980's in the United Kingdom the education system was "accused of having failed the economy" (Short and Wright 2000, p. 67). The audit explosion that followed the Thatcher government's introduction of new procedures to increase the efficiency of public servants and higher education institutions resulted in the development of the REA and now the REF (Power

1994; Short and Wright 2000). The RAE and REF epitomize the uptake of "value for money" auditing by governments.

The RAE was introduced in the 1980's, but quantifying research outputs has a decades long history in the academy. Citation metrics were originally developed to trace the history of ideas (Garfield 1955; Davis 2009). The Science Citation Index developed by Eugene Garfield was first published in 1961 and listed published articles and the number of times that they were cited (Garfield 1961). Garfield accompanied a subsequent publication of the citation index with a warning of the dangers of using citations to evaluate scientists and research by stating that his purpose in the paper was "to record my forewarning concerning the possible promiscuous and careless use of quantitative citation data for sociological evaluations, including personnel and fellowship select" (1963 p. 289-290; Cronin 2007). In particular Garfield wanted to stress that "impact is not the same as importance of significance" (p. 290). Then in 1972 Garfield published on how the Science Citation Index could be used to evaluate journals, becoming useful as an administrative tool for librarians to gauge their collections (Garfield 1972; Davis 2009).

The Science Citation Index was soon "appropriated by users for purposes for which it was unintended — as a tool for evaluating the literature, individuals, institutions and countries" (Davis 2009, p. 5). Citation analysis to rank academic journals continued to increase throughout the latter twentieth century and when online databases, such as Thomson-Reuters' Web of Knowledge or Google Scholar, emerged bibliometrics helped solidify what "counted" as academic knowledge (Burrows 2012). Thomson-Reuters' Journal Impact Factor is determined by the average number of times articles published in the previous two years in that journal have been cited (Thomson Reuters 2012). For example, an Impact Factor of 2.0 means on average

articles published in that journal have been cited an average of two times in the past year or two. As of the 2015 Journal Citation Reports, *Nature* has an Impact Factor of 41.456 and *Science* and Impact Factor of 33.611 (Thomson Reuters 2014). The Impact Factor of a journal is "used as a proxy of the quality and expected impact of each of the papers published in it" (Bordons, Fernandez, & Gomez 2002, p. 195).

An additional metric that grew out of citation indexing is the h-index. The h-index was introduced by Jorge E. Hirsch in 2005 to “quantify an individual's scientific research output” (Hirsch 2005). The h-index is defined simply as "the number of papers with citation ≥h" (Hirsch 2005, p. 16569). It is calculated first by ranking the articles of a given author in decreasing order of the number of citations per article, for example, if a researcher has 5 publications with 12, 8, 5, 4, and 3 citations, respectively, their h index is 4 (Burrows 2012; Kelly and Jennions 2006). The number is used to shortlist candidates for new positions, as a marketing device of researchers, used to predict RAE and REF outcomes, and even impacts the decisions of journal editors to accept papers written by a particular author (Burrows 2012). Hirsch originally developed the h-index for his own field of physics, but recommended it for other scientific fields in order to "estimate of the importance, significance, and broad impact" of a scientist's contributions (2005, p. 16572).

The Science Citation Index shows how metric technology can be designed for a purpose, but become redefined by its users (Davis 2009). As Burrows (2012) argues metrics have changed from simply being part of an auditing process to ensure accountability to becoming part of the process of defining quality and value. In careers advice concerning the REF it was recommended to plan one's research output with the REF in mind, ask overseas collaborators to complete their

respective research projects before the REF deadline and if not put the project on hold, and to target the field's eminent journals (Armstrong 2011). This advice doesn't provide researchers with information on how the REF works, but rather how to improve their REF performance by altering their work to meet this auditing procedure. Although the REF does not employ impact factors, the h-index is used by some universities or departments to measure a researcher's preparedness for the REF. *The Metric Tide*, an independent report of the role of metrics in research assessment, found that across the research community metrics are contested and misunderstood, peer review continues to have widespread support despite its flaws, "inappropriate indicators create perverse incentives," and that within the REF it is not "currently feasible to assess the quality … using quantitative indicators alone" (Wilsdon et. al 2015, p. viii, ix). The United Kingdom is certainly not alone in supporting the audit culture in higher education. The academic reward systems in the United States have drawn comparison to Foucault's interpretation of the panopticon prison (O'Meara 2011; Foucault 1977). Just as the prisoner is threatened with constant observation, never knowing if he is being watched, so to is the academic and this results in self regulating behaviour (O'Meara 2011).

It's important to consider these academic reward systems because they are "the valuing of people's professional lives" (O'Meara 2002, p. 77). How is the academy valuing the professional lives of academics? How are these systems of power transforming the values of science? Audits establish the definitions of quality as much as they evaluate (Power 1944). The systematic comparisons between researchers and institutions has resulted in transforming academic values and as a result transforming how academics view themselves.

Methodology

Biographical interviews were conducted with 10 academic scientists working at two universities in London. These interviews focused on their decision to pursue science as a career, their publishing practices, and their thoughts on Open Access publishing. Interviewees occupied various positions within the academic career ladder ranging from PhD students to senior Professors. The decision to interview a range of academic scientists was in order to gain a more diverse set of experiences from academic scientists and to discern if there were different attitudes to publishing along the academic career ladder. At the time of the interview, interviewees worked in a variety of scientific fields, including physics, earth sciences, paleontology, biology, and chemistry. Six interviewees were male and four were female. The identity of each interviewee and their respective university is anonymous.

Interviews were transcribed[1] and then coded for expressions of identity, mentions of audit culture, and narrative themes, which have been used to inform the following discussion. The narrative publish or perish is not restricted to the use of that phrase, but instead how academic scientists narrate their work life to discuss the pressure to publish in peer reviewed scientific journals in order to sustain their academic career and participate in the culture of academic science. As a result of all the participants working in London universities the discussion will primarily focus on auditing practices in the United Kingdom. These interviews are not intended to be representative of the experience of academic scientists, but instead provide an illuminating glimpse into the scientific identity of academic scientists and provide narratives to support discussion of the relationship between identity, audit culture, and publishing practices. The

[1] The full interview transcripts have been made openly available in Figshare with the consent of the participants, http://dx.doi.org/10.6084/m9.figshare.1522638.

narratives are constructive in nature and how interviewees narrate their identity sheds on the construction of the scientific identity.

Defining the Academic Scientist

Scientists are often described as curious, passionate, impartial and sometimes even having a priest-like calling to science (Shapin 2008; Holden 2014). Many interviewees echoed these same qualities when describing science and scientists by including descriptions such as, “natural curiosity,” “creativity without bounds,” "asking questions about the state of the world ... how things work," "discovers new things and shares,” and “exploration.” In one interview, a Professor of biology, elaborated on science as exploration:

> I see it as a form of exploration. So, in the sort of way where some people like to climb mountains or go to the poles, which has always struck me as very cold and dangerous thing to do, science offers a way, an opening to be an explorer into territories where most people can't access because they don't get to study nature and the substrata of reality that scientists do. And you get to see things for the first time. Even in this day in age when we kind of think that science has come so far so fast in the 20th century there is still an awful lot left to discover. So, it is possible, it doesn't necessarily happen every day or even that often, but it is still possible to have moments of discovery where you are the first human being to see something. ... And we get to show it to the world. It's those moments of excited where you kind of live for.

The narrative of scientists as explorers, curious about the world, and discovering answers connects to the golden age myth reported by Holden (2014). Exploration needs ample time for thinking, intellectual freedom, and typically a “calling” to discover, some natural curiosity that acts as a strong drive to support the exploration (Holden 2014). Now many interviewees were frank and said they decided to pursue science in higher education and eventually as a career because they performed well on their General Certification of Secondary Education (GCSE)

exams and General Certification of Education Advanced Level, more commonly referred to as A-levels. But interviewees also reported other reasons, such as having a love of mathematics, "got the research bug," had an inspiring teacher, explained how they chose to pursue academic science as a career despite the possibility of a higher paycheck in a traditional 9-5 job because they "like the idea that I'm free to do what I want and explore," or likes the idea of "using your wits to try to find out what nature is really like." It was a combination of the practical and passionate curiosity for the majority of interviewees. Until the development of the scientist as a career during the twentieth century "to be a scientist was a calling, not a job. Scientists were men of science, not just men in science. They had come to science driven by an inner urge, curiosity, a quest for knowledge" (Shapin 2008, p. 84; Weiss 1962). In 1956 only two corporate research groups, General Electric and Bell Labs, provided their scientists with time for exploration and others in scientific industry "actively discouraged the freeplay of curiosity" (Shapin 2008; p. 177). The increasing commercialization of science and the auditing of universities for value for money has aided in eroding the time to explore. The way that scientists choose to articulate their reason for pursuing science helps illuminate part of their motivations not only for pursuing science but for remaining in academia. For some knowing they perform well in science, just like they did on their GCSEs and A-levels, will continue to motivate their academic work, but also the drive to satisfy their curiosity, explore, and discover answers is just as an important factor in supporting their commitment to academia particularly when faced with pressures.

These traits of curiosity and exploration can easily be shared between a scientist and a non-scientist though. What is a scientist then, particularly an academic scientist? A Professor of environmental science stated that "being a scientist is a way of creating hypotheses that you can

test using either experiments or test using data." Experimentation and the scientific method are the practices that construct the scientific identity, so this is an important element to add to our definition. The Professor continued to explain that working within a science department isn't required to be a scientist and used the example of a theoretical linguist building data models of language as scientific work being conducted outside a scientific department. "You're using data for how people speak, to me, that's science," he concluded. This is an important statement to discuss in demarcating the use of scientific methods or values, and academic scientists. The Professor's definition is rooted in the importance of quantitative data and experimentation to the culture of science. In his view, performing the scientific practices of experimentation and using quantitative data can make someone a scientist regardless of their educational level or departmental association. As Shapin (2008) noted, being a scientist was originally a calling and not a job, and this dissertation focuses on the academic scientist as a job. The personality traits of curiosity and exploring illustrate that the calling to do science still remains at least in part, these traits are still present in the broader scientific culture within society, and are important in shaping how scientists view themselves as evident in the previous statements from interviewees. Utilising quantitative data and performing experiments are scientific practises that are also present in the broader scientific culture. Within the provided example, a theoretical linguist is using data and for the Professor that makes it qualify as science and in turn the linguist as a scientist. However, the definition provided by the Professor only addresses the broader scientific culture rather than the scientific culture within academia. For the purposes of a discussion on academic scientists a more focused definition needs to be reached in establishing what exactly an academic scientist is.

The primary difference between the broader scientific culture and the academic scientific culture is peer reviewed publication.

A final year PhD student in earth sciences, stated simply that “Academic scientists are like me and my colleagues who get paid to publish papers and do science, do core research.” For this PhD student publishing is a vital requirement for an academic scientist. He and another PhD student in geology both used the phrase “academic currency” to describe peer reviewed publications, and many other interviewees made statements echoing the same meaning. Publications are an important part of academic science culture and therefore an important part to the identities of academic scientists, but to what degree? When discussing publishing, he shared the following anecdote:

> One of my close friends published his paper in *PeerJ* the other day and immediately on Facebook he was like, “Guys, I'm a real scientist now!” You have to have measurable outputs these days. It's definitely a quantity game.

This anecdote is reminiscent of a scene in Disney's animated film *Pinocchio* (1940). Pinocchio was a wooden puppet who dreamed of becoming a real, human boy. At the end of the film he becomes a human boy and upon realizing this he exclaims, "I'm real! I'm a real boy!" Similar to his friend, the interviewed PhD student also remarked when discussing his first peer reviewed scientific publication, “I was an actual scientist then.” It was not the minimum six years of scientific education and training within the British higher education system that he had completed prior to this point, or the scientific research he had conducted that provided the validation of being a “real scientist.” For both the PhD student and his colleague the moment of gaining a peer reviewed scientific publication was a moment of genesis, they became real scientists, shouting, “I’m real!”

These anecdotes and statements express that gaining one's first peer reviewed publication is not only crucial to the identity of an academic scientist, but that the identity of an academic scientist is fundamentally dependent upon peer reviewed publication. As previously discussed, peer reviewed publications are a requirement for academic scientists to gain employment and move forward in their career, but the anecdotes provided by interviewees extend past promotion and tenure requirements. The anecdotes illuminate that within the dynamics of academic scientific culture publications are what effectively create the academic scientist, not the research or training. Although peer review is not without its flaws and there have been many criticisms over the practice, it is how scientific research is determined to be credible and in turn how the investment in the research is justified. Publications are how research productivity is measured with the majority of interviewees routinely describing publication as demonstrating productivity. Science depends on sharing results in order to understand, innovate, and build upon research. It would follow that continuing to publish is equally crucial to maintaining the scientific identity. If all scientists only experimented and generated data without publishing or sharing their findings, then there wouldn't be shared scientific knowledge. When discussing publishing with a Lecturer in physics, she said that, "publications are vital to your research." A Professor in biology also noted that publishing results is an intrinsic part of the research process: "Until you've published anything you haven't done anything that anybody can take any note of." Additionally, a paleontology Research Fellow, echoed a similar statement when describing his feelings after getting published for the first time:

> It felt fantastic. It was really nice to see everything formatted in that particular way and looking like a real paper. … It means you actually are a professional rather than---guess you could argue that someone that hasn't published yet, amateur's not the right word, but you're not yet producing anything yourself yet and obviously PhDs and students are

> building up to these kind of things, but until you've actually published something then you aren't contributed anything in the public domain. So, in that regard, it was definitely a good feeling. I could then publish more things and people could treat them more seriously seeing that I had a basis to what I was saying.

This narration of getting published for the first time reflects a demarcation between his previous scientific writing and his first peer reviewed publication. Presumably his previous academic scientific papers were written for courses or conference presentations. They likely reflected scientific inquiry, used quantitative data, and were pieces of scientific research. However, the are two primary differences between any previous scientific work and his first publication: the design or formatting of the publication and that it was a peer reviewed publication. The paleontology Research Fellow states "looking like a real paper." Whether or not this word choice of "real" was mindful, this phrasing illuminates the influence aesthetics of publishing may have on the scientific identity. The design and formatting provided by the publisher made his paper look "real." The typical peer reviewed article is delivered in the medium of a physical print journal or online as a PDF. The article is typeset, presented in a standard font, formatted to the style of the journal, the seal of the publisher and the logo of the journal is typically present on the first page, and each page usually denotes the journal's name and volume number. The formatting used in publications differs greatly from the basic format the majority of papers take in a word processing document. For this interviewee, the format provided by publishers made his paper look real. It is likely that the journal in which he first published followed formatting standards shared by many publishers, which would mean his published article looked like the majority scientific papers he and others use in research and cite. The association with the aesthetics of publications with "real" also points to the aesthetic of peer

reviewed journals being associated with quality.This statement sheds light that publishers may be providing additional value to publications through design.

Additionally, the peer reviewed status of the paper also plays a role in his comment that it became a “real” paper. His previous scientific work was likely reviewed by supervisors and colleagues within the department, but now that his research was peer reviewed for a scientific journal and published it became real. It was real, because it now was part of the “public domain” of science, knowledge that he contributed to his field and scientific culture as a whole. As the Research Fellow notes, he anticipated that the publication would also bring him credibility as a researcher and that other academic scientists would begin to treat his scientific ideas more seriously. The publication validated him, contributed to his identity as a real scientist both internally and externally. Now it wouldn’t be possible to verify his assumption that he was externally validated is true without interviewing his colleagues, but in a separate conversation with the Professor of environmental science about how the publications and citations of his fellow scientists impacts his assessment of them he stated the following:

> If I'm talking to another academic and they hardly have published at all, I would question... maybe I'm being snobby... but I would want to know in my head, why haven't they published in the last five years? I'd be questioning, has something happened to them? Or are they just not publishing? I think, again, I'm probably being a bit snobby, but would I put as much kudos on what they were doing as a researcher? I'm not sure that I would.

The Professor qualifies his statements by vocalizing his fear that he is being “snobby.” However, it appears that he is practicing scientific values rather than just being a judgemental colleague. If academic scientists are scientific researchers who publish in peer reviewed journals, then his concerns over their lack of publications would fall in line with scientific values. If the

academy evaluates the credibility of science and the contributions of a scientists through peer reviewed publications, it would naturally follow for individuals within the academy to evaluate their colleagues in a similar manner. Other interviewees made statements about how continuing to publish was needed to receive grants and continue one's research. A Reader in chemistry, made such a point: "If you stop publishing for a couple of years you'll probably find it more difficult to get grants and you'll indeed perish." Additionally, a Professor of chemistry, who is also a line manager makes note that when conducting appraisals she has to be "honest" with faculty who have a lower amount of publications by saying: "'Look, you really need a few more first author papers to really go that next step [promotion].'" Publications are required to advance in an academic scientist's career and potentially have an impact on the ability to secure funding for future research. Very few interviewees expressed negative pressure to publish and some even stated they thought the pressure was a good motivator, but many were concerned with funding and being denied a promotion would be a negative setback for an academic. Although interviewees did not explicitly narrate a pressure to publish, they narrated an understanding of the publication expectations in the academy, what one interviewee referred to as a "quantity game." Furthermore, the interviewed academic scientists not expressing a negative pressure to publish and at times even narrating the pressure as good supports Foucault's concept of power as productive and not repressive (1980). Foucault writes that "What makes power hold good, what makes it accepted, is simply the fact that it doesn't only weigh us as a force that says no, but that it traverses and produces things, it induces pleasure, forms knowledge, produces discourse" (1980, p. 119). The pressure to publish within the audit culture of academia is productive in that it mobilises academics to produce and publish, reward systems are built within the power system

to incite this mobilisation, but most of all, an academic scientist's identity is dependent on publishing. Audit culture in academic science primarily evaluates based on peer reviewed publications and through this system of power it has established a quality and reward systems. The interviewee's comments illustrate the dynamics within academic science culture and how important publishing is for one's identity as an academic scientist.

The rest of the interviewees were more established in their career, had numerous publications, and largely had completed their PhD one or two decades ahead of the interviewed PhD students. Their narrations of PhD and early career research work life were not expressed in the same manner that PhD students used, which implies living a different experience and working under different conditions. A Professor in chemistry who completed her PhD twenty years ago described her PhD as "pottering around and making new compounds just to see why they're interesting and so on." A earth sciences PhD student's statement that "you have to have measurable outputs these days" is reminiscent of the golden age myth, alluding to some time before the present when he believes one didn't need the same measurable outputs. Whereas the chemistry Professor's statement implies having ample time to tinker with new ideas and explore. The history of scientific publication shows this emphasis has been well established for nearly a century, but the focus on quantity and metrics continues to grow and this is well reflected in the interviews. For the earth sciences PhD student and paleontology Research Fellow whose first publications were previously discussed, getting over the hurdle of one's first peer reviewed publication meant becoming "real" and gaining more respect from their colleagues.

The choice of the word "real" is significant. Perhaps not all PhD students or early career researchers would narrate their work life in the same way or feel the same way about publishing,

but their narration does shed light on the dynamics of academic science culture. Peer review publication validates the scientific work of academic scientists, validates the work of students and early career researchers as real scientist, and plays a continuous role in how academic scientists view themselves and evaluate their colleagues. Academic scientists often have the traits associated with scientists in popular culture, such as curiosity and being objective, but in their role as an academic scientist they are researchers who publish. The scientific identity is constructed by publishing, an academic scientist is made through publication.

The Impact of Metrics

As discussed previously, metrics, such as the Journal Impact Factor and h-index, have become part of defining quality and value in publications. Publishing is vital to the scientific identity and metrics are intertwined in the valuation that informs the scientific identity. The Impact Factor of a journal is often used to determine the quality of the journal and deem whether it is a 'top tier' journal (Burrows 2012). Metrics are used to determine the impact an author has, whether through basic citation count or the h-index, and a journal's impact factor is used by some to determine the value of an individual's research simply by association. A Professor of biology commented that he personally does not feel a negative pressure to publish, but discussed his concerns over the use of impact factors and how it influences publication decisions:

> Now people are judged more and more on where they publish than what they publish. One has to be very careful about those pressures, because they tend to be --- there's a risk that they may be distorting the system. In my view they're making it more expensive than it has to be, they're putting undue pressures to cut corners potentially. It also slows down the whole business of science publishing and communicating because they're always aiming for the top tier journals and then working their way down and so it can often take a year or more to get a paper published where the whole process of review and publication if you go through it once it should only take two or three months at max.

His note that academics are being valued based on “where they publish” rather than based on the quality of their research is concerning. Peer reviewed journals provide assurance of quality and citation metrics originally began to trace the history of ideas, but instead are being used to quantify the impact and importance of research. The current structure of reward systems in higher education, a result of audit culture, has contributed to academics chasing impact factors. A PhD student in earth sciences echoed similar concerns when describing the culture of his university’s department: “impact factor mania drives quite bad practice. … My colleagues are certainly all addicted to it [Impact Factor]. They refuse to submit to IF 4 or less, which is ridiculous.” When this PhD student gained his first peer reviewed scientific publication he was met with negative remarks from his colleagues in relation to Impact Factor:

> My very first paper was published in *PeerJ*. I was really happy when it came out. It was my first peer-reviewed publication. I was an actual scientist then. I was with some colleagues after that and several of them were like, “Well, it doesn't really count, does it? Because the journal doesn't have an Impact Factor.” And the pressure you feel as you get kicked in the nads by the hammer of science was pretty shit. You've just spent many, many months working on this stuff and you're told it doesn't count, because it doesn't have some arbitrary label attached to it.

PeerJ is a peer reviewed Open Access publisher that was launched in June 2012 (PeerJ 2015). *PeerJ* joined Journal Citation Reports in December 2014 and received a "partially 2014 Impact Factor" in June 2015, since the qualifying articles to establish the metric on have only been published for 12 months instead of the full 24 months that Journal Impact Factor is based on (PeerJ 2015). However, at the time that this PhD student was published *PeerJ* did not have an Impact Factor. As previously discussed that first publication is a vital moment for a early career scientist and helps establish them as a “real” scientist and validates them within academic

science culture. To have the achievement undermined for an “arbitrary” metric rather than the quality of the science not only undermines the work, but also the scientific identity. He was told that his first publication, which made him feel established as an actual scientist after years of studies didn’t count. His colleagues who prized impact factors in order to validate research were unconsciously sending him the message: ‘You don’t count as a real scientist, because the journal you published in doesn’t have an Impact Factor.’ The prizing of Impact Factor resulting in the perceived nullification of another’s scientific identity is alarming. The following anecdote that the Professor of biology shared during a discussion on Open Access publishing also provides additional context to how the scientific identity is undermined when metrics are emphasized:

> There was something over Twitter over the weekend, some PI, I don't know who they were, they weren't named or anything, but some star PI said they would never publish something in *PLOS ONE* and they would rather not publish something than publish in *PLOS ONE* even though, I think, this particular situation was costing a PhD student a publication. They weren't going to get a publication out of it, because the senior author felt that to be an author on a *PLOS ONE* paper would damage his reputation. I think that's a silly attitude to strike and one that's damaging obviously for the career of the student and I think it's entirely selfish and inappropriate.

The Public Library of Science, PLOS, is an Open Access publisher and *PLOS ONE* is its flagship multidisciplinary journal that was launched in 2006 (PLOS 2015). Since the Principal Investigator discussed by the interviewee is not known and cannot be interviewed it isn’t possible to determine exactly why the Principal Investigator said that they would never publish in *PLOS ONE*. However, the reason for that particular researcher’s decision isn’t wholly relevant, but rather this anecdote is particularly interesting because the researcher’s decision to not publish at all undermines the motivating to publish in the scientific identity. Determining a possible reason isn’t as simple as applying the comments made about *PeerJ*, as *PLOS ONE* does

possess an Impact Factor of 3.234 (Thomson Reuters 2014). The likeliest reasons are either that the Impact Factor of 3.234 is not sufficiently high enough for the Principal Investigator and/or the Principal Investigator questions the quality of *PLOS ONE*'s large scale Open Access publishing. The Impact Factor not being sufficiently high enough echoes the PhD student's statement that his colleagues refuse to submit to journals with an Impact Factor of less than 4.

Smith made a clear statement that academics are judged more for where they publish rather than what they publish. In Nature Publishing Group's recently published Author Insights survey, 97% of surveyed published scientific researchers rated the reputation of the journal as "important" or "very important," and 90% rated the journal's Impact Factor as "important" or "very important" when deciding where to submit (NPG 2015, p. 4). This Principal Investigator thought publishing in an Open Access journal with an Impact Factor of 3.234 would "damage his reputation." The power systems of audit culture that have commercialized higher education and the increasing emphasis on metrics have defined quality, both for journals and researchers, as high impact. Whether the publication in *PLOS ONE* would have damaged the Principal Investigator's career is irrelevant, because he still perceived a threat and reacted to it. Publication is a vital part of constructing the scientific identity, it is the largest motivation provided by scientific culture and audit culture, but yet the perceived threat to one's reputation likely based on metrics defined value led this academic scientist, and likely others, to forgo publication entirely. This anecdote is made worse, because a PhD student lost out on a publication, and as previously discussed publications are especially important for early career researchers to establish their scientific identity. Burrows warned that academic values were being transformed by metrics and for many researchers this transformation has been completed. Audit culture has

successfully transformed the way way academic scientists view themselves based upon publications. The increasing emphasis on citations and prizing impact factors is shaping the values within academic science, and will in turn affect how scientists view themselves and their colleagues. These anecdotes are evidence of this shift.

However, unlike publications, metrics aren't embraced as a total value within the scientific community. Metrics are widely used and embraced, but among individuals the conversation does not always follow the experience of the interviewed PhD student. When discussing how his colleagues may use metrics in evaluating his research, a Research Fellow in physics, said that "They will all tell me they don't, but they will a bit." He added that when he is complimented by colleagues "it's not about my citations, it's about their own judgment." Although this Research Fellow expressed a lack of care for impact factors himself, he did say that he feels pressure to publish in high impact factor journals, because his CV is lacking in "high impact factor papers and that would make it a lot easier to get a permanent job." As a Research Fellow he is on a limited contract and his research must be restricted into a three year window, which limits his abilities to conduct larger projects or apply for funding. He expressed an understanding of how the audit culture in the academy works and how metrics play a role in his ability to get a permanent job. Metrics also impact the promotion of well established scientists. When the Professor of environmental science applied for a promotion from Lecturer to Reader within his department he was denied due to lacking publications in high Impact Factor journals:

> When I first applied to a promotion to a Reader and I didn't get it, I was really quite upset, but the Dean came to see me and said, 'The reason you didn't get Readership was you should be publishing in *Science* and *Nature*, you should be the top 5% of your field.' That kind of stuff. And this is a person who was telling me this who had much fewer

> publications records than I did, and I was just a Lecturer and he was a Dean. I was absolutely shocked that to get promotion at any kind of level that you need to publish in, what I would say, these vanity journals[2]. I thought it was absolutely abhorrent. I vowed that I would never try to publish in those journals to get promotion.

He was not being told that his research was flawed or it wasn't at the quality level of a Reader, but rather that he simply wasn't publishing in high Impact Factor journals. Many participants expressed an understanding of why hiring committees might use journal name recognition or Impact Factor, conceding that quantifiable metrics speed up the hiring process and help distinguish between otherwise similar candidates. In his case this was for a promotion and the quality of Readership had been defined as publications in the journals with the highest Impact Factor. Auditing is a power based relationship with those being observed being made into objects of information rather than participants in communication (Foucault 1977). Burrows warned that the great focus on metrics with Impact Factor and the h-index is transforming academic values (2012). The experiences of interviewees illustrate this transformation. Financial viability, audits, and institutional reputation are concerns for universities (Holden 2014). Metrics play a key role within audit culture and proving a university's value for money and their reputation. A Professor of chemistry noted that her "department did a conscious thing a few years ago by pushing the higher impact publications up, which really was a result of the last REF [RAE 2008]. … Trying to push higher." Her department made this "conscious" decision in preparation for the RAE although the RAE

[2] The use of the phrase "vanity journals" is very interesting as it resists the definition of quality in metrics focused academia as well as deviates from the standard vanity publishing definition of authors paying for their work to be published. Here the interviewee is calling the high impact factor journals that many of his scientific colleagues strive for "vanity" publications. For this Professor, the high impact factor journals are not representative of quality or the best research, but rather a source of feeding egos. By vowing to never try to publish in these vanity journals for the sake of promotion he is resisting the values of audit culture, resisting the power system, and in doing so is beginning to shape a different kind of scientific identity, one that is still constructed with publishing though. It's a very intriguing idea and one that should be explored further in another paper.

officially stated that "no panel will use journal impact factors as a proxy for assessing quality" (Research Assessment Exercise 2008, par. 32). The policy of not utilizing Journal Impact Factor during assessment has continued into the REF. Whether or not it is truly possible for a RAE or REF panel to not consider a journal's reputation or Impact Factor, even as unconscious bias, is for another investigation. But it is clear that the universities, their departments, and their researchers have associated metrics with indicated success in the RAE/REF audits. Metrics are associated with quality as a result of audit culture. Audit culture cultivated metrics as a way to asses the quality and impact of research, and metrics have been introduced into routine scientific practices with increasing support from universities and through audits that are disguised to empower researchers. As a result metrics are used both by individual academic scientists and the departments and universities that collectively represent academic science to police themselves as individuals and entities within the system of audit culture. The use of metrics in academic scientific culture performs and constructs the scientific identity, altering how academic scientists view themselves and their colleagues.

The Professor of environmental science eventually received promotions and is now employed in the rank of Professor at his university without publishing in either *Nature* or *Science*, but the pressure to obtain publications in certain journals based on metrics and reputation is pervasive in the experience of academic scientists. The previous comment that the publishing process can take a year or more than than two or three months due to researchers going down tiers with submissions reflects a shift in the values of science. Publication is done to share the results of research, contribute to the knowledge of a scientific field, and validate scientific ideas. The quest for a high impact publication slows down the publication process

putting the value for metrics above the value for sharing. When the values of science are transformed, so too is the scientific identity.

Conclusion

We depend upon systems to get facts to travel well and when these systems are subverted or compromised there is danger of failure (Howlett and Morgan 2011). Peer reviewed scientific journals are one of the most trusted systems to disseminate facts and scientific knowledge. Audit culture's influence on the scientific identity has resulted in a publication system where academic authors are more focused more on metrics than disseminating science. The increasing emphasis on metrics, such as the Journal Impact Factor and the h-index, has transformed how academic scientists view themselves and their colleagues. Interviewees reported they or their colleagues adjusted their practices and themselves to meet metrics expectations, ranging from commonly submitting to journals with a certain Impact Factor or higher to extremes such as deciding not to publish in a low Impact Factor journal in order to maintain a perceived reputation. This dissertation used interviews with academic scientists to illuminate the scientific identity and explore the influence of audit culture and through narratives.

Academic scientists expressed a sense of identity, of becoming a "real scientist" by gaining peer reviewed publications. A pressure to publish in high impact journals in order to advance in their career was also reported, and some academic scientists shared anecdotes where their scientific identity was undermined because of the perceived lower value of journal based primarily on the Impact Factor. Publication is not simply a career achievement, it is a moment of genesis for the scientific identity. The pervasive phrase "publish or perish" narrative that is used

to characterize and narrate the life of an academic might be what Bolman and Deal refer to as a "shared myth" (1991, p. 253). Shared myths create cohesion in a profession, maintain support, and provide a way to make sense of experiences in the midst of chaos (Miller, Taylor & Bedeian 2011). The publish or perish narrative is shared within academia, it is used to narrate a scientist's work life, to establish the values of the profession, to understand one's role as an academic scientist, and through the power of audit culture it is used to maintain support for the present system. This narrative, this shared myth of publish or perish is used to construct the scientific identity. Audit culture has resulted in the academic scientific identity not being constructed by the typical practices of experimentation and objectivity that are usually associated with scientists, but instead a scientific identity that is dependent on publishing. The phrase "publish or perish" is typically interpreted as if an academic ceases to publish, they will lose their university job. These interviews revealed a deeper meaning that exists past metaphor and is at play in this constructive narrative and within the dynamics of academic science culture. Perishing is not simply losing a job for an academic scientist. If an academic scientist stops publishing, they stop being a scientist. Perishing is losing one's identity. However, through academic scientists that resist the values of audit culture a different kind of scientific identity may form that is not constructed on the values of audit culture and dependent on publishing.

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Appendixes

Appendix A: Ethics Certificate

DEPARTMENT OF
SCIENCE AND TECHNOLOGY STUDIES

UCL

This document certifies that

Chealsye Bowley

has received ethical approval for their project entitled

"I'm Cited, Therefore I am!": The Scientific Self, Myths and the Impact on Open Access

in accordance with the UCL Department of Science and Technology Ethical Research policies and procedures.

Application reference number: STSEth055

Signed: Director of Research

Date of Approval: 21 May 2015

Appendix B: Interview Information Sheet

Information Sheet – Participant experiences of interviews for the USL STS MSc Dissertation I'm Cited, Therefore I am!: The Scientific Self, Myths, and the Impact on Open Access

Interview Information

Thank you for agreeing to participate in an interview discussing your academic publishing practices.

The interview will explore participants' experiences of academic pressure, their academic publishing practices, and opinions about Open Access publishing. Your comments will be used to discuss how the identity of academic scientists impact their publishing practices, so please be as open and honest as possible within the interview.

These interviews are being conducted by Chealsye Bowley, a University College London Science and Technology Studies MSc student, and results from the interviews will be discussed in her dissertation. The findings may also be published in a suitable peer-reviewed journal, or summarised in other reports or materials. With your permission the anonymised transcript will also be archived in a suitable data store for potential future use by other researchers.

The interview will last approximately 30-45 minutes and your comments will be made anonymous in all reporting documents. I request the ability to report your general field of study and university rank. All other personal details will be anonymized in the transcript, dissertation, and any additional published reports. Your university will simply be identified as a London university and be labelled with "1" or "2" within the data. No one supervising the dissertation, elsewhere within University College London, or the public will hear the recordings or be able to connect specific participants with any of the reported project findings. Participants' names and contact details will be stored securely and in a separate location to any comments made. The interview will be audio recorded and you may stop the interview at anytime.

Withdrawal

If, following the interview, you decide you would prefer not to participate in the project, or would like to remove specific comments from the data set, please contact the researcher at the address below by 30 July 2015 and your comments will be withdrawn from the study.

Chealsye Bowley
Email: chealsye.bowley.14@ucl.ac.uk

If you have any queries or comments about the interview please don't hesitate to get in touch. Many thanks once again for agreeing to be involved.

Best wishes,
Chealsye Bowley

Appendix C: Consent Form

Consent Form – Interviews for UCL STS MSc Dissertation --- I'm Cited, Therefore I Am!: The Scientific Self, Myths, and the Impact on Open Access

Thank you for agreeing to participate in the interview. Please indicate Yes (Y) or No (N) in the appropriate boxes to signify that you have understood and agree with the relevant following statements:

		Y/N
1.	I have read the interview information sheet and understand the information provided and my role as a participant	
2.	I understand that my participation is entirely voluntary and that any information used for reporting purposes will be made anonymous	
3.	I agree to for my field of study _____ and my rank _____ to be reported in the data and dissertation	
4.	I agree to participate in the above study	
5.	I would be willing for an anonymised transcript of my interview to be placed in a suitable data store for potential future use by other researchers [*the interview can still go ahead if you disagree with this suggestion*]	

Name of Participant _____

Signature of Participant _____

Date _____