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The Practice and Poetics of Fieldwork: Hugh Cott and the study of camouflage. Journal of Historical Geography

Abstract

This paper examines the practice and poetics of the British zoologist Hugh Cott's fieldwork in order to explore the hybrid nature of developments in biological and military camouflage. Specifically focusing on two fieldtrips conducted in the 1920s to the Amazon and the Zambesi, and by examining how Cott communicated his scientific findings through photography and art this paper reveals that the performance of scientific knowledge production is spatially contingent; born of embodied, creative and demanding experiences and through multiple human and nonhuman engagements. Finally, it examines how this knowledge was transferred and utilised to develop mid-twentieth military camouflage. Thus, this paper considers how the craft and aesthetics of fieldwork shapes how nature is observed, recorded and communicated as scientific knowledge and military technology.

Keywords:

fieldwork, biography, camouflage, science, art, observation

Hugh Cott (1900-1987) was a British zoologist, dedicated to the study of adaptive coloration in nature (or camouflage); he was also a proficient wildlife photographer, gifted technical illustrator and influential Second World War camoufleur. The relationship between Cott's scientific-self and these other diverse and seemingly discrete aspects of his character raises interesting questions surrounding the cultural nature of knowledge production and the performance of science. In particular, Cott's combined use of the scientific and the aesthetic to communicate the uses of biology to the military is a useful means through which to narrate the history of camouflage as an entanglement of science, art and militarism.

Years dedicated to the study of biological camouflage had led Cott to realise that the means by which animals render themselves inconspicuous could be inversely employed in art, so as to reveal the magic of their camouflage techniques and to communicate his scientific study on the subject. It is by attentively studying Cott's drawings - his intricate attention to detail and concern with lines - that his field practices, as both art and science, and his interdisciplinary approach to camouflage can begin to be glimpsed:

The artist, by skilful use of light and shade, *creates upon a flat surface the illusionary appearance of roundness*: nature, on the other hand, by the precise use of countershading, *produces upon a rounded surface the illusionary appearance of flatness*.¹

Cott worked solely with black Indian ink on white paper, which gives his illustrations a crisp, clean, stencil-like finish (fig. 1). The drawings were copied from his field photography, and thus his art is imbued with a sense of energy, as a former student of Cott's recalled: 'His works have a tremendous liveliness in the forms of the animals that he draws, not dead animals or stuffed specimens'.²

Cott's illustrations are distinctive because of their level of detail, since his interests lay in understanding and exposing the use of texture and tone in natural camouflage, his scientific drawings are characterised by exploring those features through the relationship between background and object: 'A distinguishing feature of the pen and ink drawing is its capacity for intense contrasts of tone. The blackness of the Indian ink stands out from the whiteness of the paper, and if properly managed the pen work has a bright and almost sparkling quality'.³

The deftness of Cott's pen crafts lines, which hatch, mesh, wind, cross, curl, squiggle, swirl, scratch, wave, block, sweep, weave and trail, across the page. Through their relations to one

¹ H. Cott, *Adaptive Coloration in Animals*, London, 1940, 36. Italics are in the original text.

² Conversation with Stephen Tomkins, 25th May 2010, a former student of the Zoology Department at Cambridge who had been taught by Cott in the early 1960s close to his retirement in 1967.

³ H. Cott, *Looking at Animals* (note 3), 201.

another, these lines work ink into a smooth shiny beak, or give texture to feathers, whether of downy softness, or waxy sleek tips. Skin, fur, horn, bone, earth, leaves, bark, stars, moist, rough, smooth, tacky, cloying, jagged and dry: these objects and sensual qualities are conjured through Cott's illustrations. His animals and landscapes are constructed through a multitude of systematic and irregular lines, which assemble to become 'intrinsically dynamic and temporal'.⁴ Cott's lines are intrinsically spatial, conjuring the blank space of the page into lively, sensual places (fig. 2).

Further, it is through these graphic illustrations that we sense Cott within the science, as an active participant. Cott described his drawings as: 'half-way between a thing and a thought; between a recording of fact and a revealing of experience'.⁵ And that: 'the real work – a sort of hidden asset – that goes into the drawing comes not from the hand, but from the heart'.⁶

We also can sense the impact of witnessing the places in which his fieldwork was conducted; indeed, his appreciation and admiration for nature is portrayed through his art. His vivid portraiture revelled in texture, tone and the individual character of the animals studied. Each illustration draws the likeness and type of an individual *and* biological life: the eyes have expression, the gait and posture portray more character than just an example of species behaviour. Therefore, how the scientist observed, interpreted and ordered nature, and how nature influences science, can all be glimpsed through Cott's illustrations; thus he divulges something of himself too. The drawings at times avoided an outline containing the animal (fig. 3), which reflects Cott's fieldcraft where his own outline, as scientist, artist and soldier, blurred into the natural environs. As Bleichmar has commented: 'some activities, practices and objects that we have come to call art and some that we now think of as science informed one another'.⁷ For Cott, the study of biological camouflage, although a scientific matter in the main, could be also understood, communicated and authenticated through an appreciation of its artistic qualities. Therefore, the use of scientific illustration not only allows insight into Cott's technique of using visual aids to shape and validate his research, his drawings also flesh out his scientific biography: through consideration of science *and* art, Cott and the history of camouflage become livelier.

Cott and camouflage

⁴ T. Ingold, *Lines: A brief History* London, 2007, 72.

⁵ H. Cott, *Uganda in Black and White*, London, 1959, 13.

⁶ H. Cott, *Looking at Animals: A Zoologist in Africa*, London, 207.

⁷ D. Bleichmar, Learning to look: visual expertise across art and science in eighteenth century France, *Eighteenth-Century Studies*, 46, (2011), 87.

Colleagues and former students of Cott's recall a man who was a 'chip off the old empire' with a formal exterior, but which underneath lay a great capacity for sensitivity (fig. 4).⁸ Conversations conjure a man always attired in a three piece suit, with a bristly toothbrush moustache 'of a kind chaps had in the Second World War'.⁹ The study of animals' adaptive colouration and patterning for Cott was by necessity the study of science in the field - observing animals in their place. This technique of biological study came at the tail end of the Darwinian approach to scientific research, and thus, his science was not widely celebrated. As Cameron and Matless explain; 'What we consider "nature" is always historical and relational, shaped in contingent configurations of representational and social practices'.¹⁰ Obituaries recorded Cott as:

a scholar who scorned fashions, and was often out of step with the scientific establishment of the day.¹¹

Cott was very much a classical zoologist. It is not often realised nowadays how far ahead of his time he was at the height of his career.¹²

As a result, Cott's scientific life, so far, has been largely overlooked. Yet, by attending to the artistic and military elements of his biography alongside the scientific it is ripe for consideration, particularly at a moment when there is increasing interdisciplinary interest in critical militarism and the hybrid human/nonhuman assemblages and nature of modern technologies and scientific knowledge.

Thus, this paper brings Cott's scientific text, field photography and Indian ink drawings into dialogue to explore the particular, and at times peculiar, field practices and poetics that informed his scientific research into camouflage. Focusing specifically on two of Cott's field expeditions in the mid-1920s -to the Zambesi and the Lower Amazon - the performance of his fieldwork as a process of becoming corporeally connected to nature through a dynamic network of human/nonhuman encounters, scientific practice, technological innovation and artistic engagement will be examined. This scientific biography offers insight into the hybrid nature of fieldwork and the entangled nature of knowledge production. First, the paper considers the contribution a geographical perspective can make to the history of field science and scientific biography, before I turn attention to Cott's fieldwork practices and his efforts to communicate his findings on biological camouflage. Finally, the paper will examine how Cott's science

⁸ Conversation with Stephen Tomkins.

⁹ Conversation with Stephen Tomkins

¹⁰ L. Cameron and D. Matless, Translocal ecologies: the Norfolk Broads, the "natural" and the International Phytogeographical Excursion, 1911, *Journal of the History of Biology* 44 (2011) 15

¹¹ St Joseph Obituaries, Selwyn College Calendar 1987.

¹² *The Times*, Obituary 25th April 1987, pasted into Cott, H. *Adaptive Coloration in Animals* – Cambridge Zoology Museum [hereafter CZM]- Box 2 .

positioned him to be utilised by the military in the Second World War to develop camouflage technology, transferring biological science to military hardware.

Historical geographies of fieldwork and scientific biography

Cott had a passion for natural history and its significance can be located in specific sites throughout his life. For example, in boyhood, he could be occasionally found on a small island in the lake of Combe Abbey raiding nests for eggs to study, a violence of curiosity unthinkable today.¹³ In his late teens when serving in the British Army in Ireland, Cott filled precious hours of leave with fieldwork.¹⁴ Then later in Second World War, as one of “Monty’s” Desert Rats, Cott divided his time between instructing camouflage trainees on the techniques of concealment and deception, and studying the adaptive coloration of desert lizards, snakes and mammals. Cott found the potentials for fieldwork and the intrigue of nature across many places in his life from expeditions to study ‘exotic’ wildlife, to the detailed study of his domestic cats and under the rigours of military service. Due to the nature of Cott’s science this led him to spend much time immersed in many different environs in order to appreciate and understand the full spectrum of biological camouflage techniques.

This focus on field science and natural history raises cultural questions surrounding the practice of science. The field is often a site rich with the rhetoric of heroism ‘with its elements of direct action, lonely commitment, and manly risk’ as a place where culture is enacted and constructed, where science is performed and legitimised.¹⁵ Despite this pervasive view, the field has also been depicted as a site wrought with tension between the supremacy afforded to knowledge of the informed, trained scientist - as Godlewska describes through, ‘his own observations which gave him the ability to sort through and judge that mass of facts’ - and fears that the personal and individual could not necessarily be trusted, as Outram explains due to the fact that knowledge from the field ‘could not be experimentally replicated and was not produced in front of an impartial and freely assembled audience.’¹⁶ Thus, the field can encourage contradictory views; ‘being more than the place where knowledge in particular fields is formulated and tested; it is also where the personal and the professional collide’.¹⁷ To this Baker reveals the field to be a

¹³ Letter from Hugh Cott to Prof. Kerr, 16th May 1939, Glasgow University Archives, DC6/709 [hereafter GUA].

¹⁴ List of publications 1921-1960 H.B. Cott, CZM Box 2 and H. Cott, Notes on the birds of Inishbofin, *The Irish Naturalist*, 34 (1922), CZM Box 2.

¹⁵ B. Hevly, The heroic science of glacier motion, *Osiris* 11 (1996) 66.

¹⁶ A. Godlewska, From enlightenment vision to modern science? Humbolt’s visual thinking, in D. Livingstone and C. Withers (Eds) *Geography and the Enlightenment*, 1999, London, 246; D. Outram, On being Perseus: new knowledge, dislocation, and enlightenment exploration, in D. Livingstone and C. Withers, *Geography and the Enlightenment*, 283.

¹⁷ K. Richards, The field, in: J. Agnew, D. Livingstone, (Eds) *The Sage Handbook of Geographical Knowledge*, 2011, London, 54.

creative and sensual space for the production of scientific knowledge, whereby imaginative possibility fuels scientific inquiry: 'The Earth can speak to us semiotically just as great books speak to us. We can converse in these inquiries if only we possess the imagination to do so'.¹⁸ Fieldwork, therefore, requires attentive listening and imagination to decipher the systems and processes which work across, sculpt and are inscribed upon the Earth.¹⁹ This embodied consideration of fieldwork offers a means to scrutinise Cott's scientific practice, and account for what Hevly has described as the 'nonquantifiable elements' which links the scientist to 'the aesthetics of nature, the sublime or the picturesque elements of natural settings'.²⁰ Cott's science was highly visual and aesthetically particular, and his chief scientific method was observation; reading the bodies, patterns and colours of animals in order to elucidate their means of camouflage. This method required him to conduct numerous expeditions to different continents, to a variety of environments, and to transform personal observations into a quantifiable, trustworthy and universal science on camouflage. Daston and Lunbeck have considered the history of scientific observation as a process whereby 'the private experiences of individuals have been made collective and turned into evidence'.²¹ Thus, Cott demonstrates how a single scientific biography can contribute to wider on-going discussions on knowledge production and the hybridity of scientific practice.

Livingstone has discussed that attending to the 'spaces of a life could open up new and revealing ways of taking the *measure of a life*'.²² Therefore, focus on the individual raises the importance of sites of scientific practice, knowledge production and dissemination. The spaces and places of science matter and the narrative of a life is intrinsically spatially-shaped, as well as temporally, and therefore a geographical lens can be an insightful method through which to study both the development of science and the lives contributing to its production. Porter explains that 'the culture of science shapes and is shaped by the people who practice it and ... the scientist, as a human type, has a history that matters'.²³ Furthermore, he suggests that scientific biographies should give an account of the particular habits and behaviours of the scientist that are shaped by their external relationships, circumstances and other aspects of their character. As a result, 'a more inclusive biographical study can provide materials for a history of the scientist, a vital

¹⁸ V. Baker, *Conversing with the earth: the geological approach to understanding*, in: R. Frodeman, (Ed) *Earth Matters: Philosophy and Geology*, New Jersey, 1999, 8.

¹⁹ V. Baker, V. Fieldwork, in: S. Harrison, S. Pile, N. Thrift (Eds) *Patterned Ground: Entanglements of Nature and Culture*, London, 2004, 136-137.

²⁰ B. Hevly, *Heroic science*, (note 15), 86.

²¹ L. Daston and E. Lunbeck, *Observation observed*, in: L. Daston and E. Lunbeck (Eds) *Histories of Scientific Observation*, London, 2011, 2.

²² D. Livingstone, *Putting Science in its Place, Geographies of Scientific Knowledge*, Chicago, 2003, 183, emphasis in the original text.

²³ R. Porter, *Is the life of the scientist a scientific unit?* *Isis*, 97 (2006), 314.

dimension of the history of reason in the world'.²⁴ Therefore, by focusing on the personal, there is the possibility to narrate the history of scientific discoveries and developments through an individual's social, political and cultural networks. A scientific biography is hence a tool whereby the entwined lives of Cott and the development of camouflage knowledge and technology, both of which he greatly contributed, can be traced. To achieve this spatial analysis of Cott's scientific biography Lorimer's suggestion that we need not narrate subjects' entire life histories as 'a fixed arc that begins, happens and ends', but instead construct 'more mobile biographies told through different episodes or moments happening within the longer context of a life' is appealing.²⁵ This paper draws attention to moments, places and sites of Cott's life, not in an effort to close in around the individual, but rather, as a means to extend the breadth and cast greater clarity on the history of camouflage and the nature of knowledge production. As McGeachan, Forsyth and Hasty have described, it is by attending to the spatial qualities of a life that the overlaps between seemingly disparate identities within a life can begin to be acknowledged and explained.²⁶ Narrating Cott and his intersecting biography with camouflage is a means to reveal the reciprocal and entangled relations between science, art and the military in producing scientific knowledge and technological innovations. It also presents an opportunity to explore Cott's embodied engagement with nature, allowing for what Pickering calls the 'performative image of science'²⁷ to be examined and the relation between human and nonhuman in science acknowledged. In particular, by exploring early research expeditions undertaken, and the field methods employed, a more holistic perspective on Cott's enrolment of the natural and material in scientific practice and military technological development can be analysed.

The craft of fieldwork

Since childhood Cott had nursed a passion for natural history and, as a young man, this passion coincided with a military posting. From 1919 to 1921, Cott served in the Leicestershire Regiment in Ireland.²⁸ During these three years Cott found time to pursue his interest in natural history. Activities such as ornithology have, historically, been encouraged by the British military. Greer has examined the intersection between military culture and the practices and ideas of ornithology during British colonialism, noting how it was seen to be a healthy pastime for British

²⁴ R. Porter, Is the life of the scientist a scientific unit (note 23), 321.

²⁵ H. Lorimer, The geographical field course as active archive, *cultural geographies*, 10, (2003), 283.

²⁶ C. McGeachan, I. Forsyth and W.Hasty, Certain subjects? working with biography and life-writing in historical geography, *Historical Geography*, 40 (2012) 169-185.

²⁷ A. Pickering, *The Mangle of Practice: Time, Agency and Science*, London, 1995, 7, emphasis in the original text.

²⁸ Papers of Hugh Bamford Cott (1900-1987) Zoologist, Selwyn College Archive SCA | G | BR/0276/HC.

military officers.²⁹ To this, Livingstone has described how, '[m]orally and materially, *where* we are matters a good deal in trying to figure out *who* we are'.³⁰ It is, therefore, not unusual that, while serving in the military Cott began to carve out an identity as an authority in ornithology, and also began to absorb a military precision in his fieldwork practices. It was during this period that Cott first published some of his natural history observations, with articles appearing during the early 1920s in *British Birds* and *The Irish Naturalist*.³¹

From his experience in Ireland, Cott duly realised that military life and science did not necessarily operate independently from one another, something he would later exploit, whilst serving in the Second World War. Kirsch has drawn attention, in a study of the US Department of Energy's Savannah River Site, to how 'thriving' landscapes can be both a productive site of environmental knowledge and emblematic of military practices.³² These sites of scientific knowledge production and military practice exist concurrently within the landscape; they engage in conversation with the local environment and with one another. Cott responded to places as active military landscapes *and* as fruitful scientific fieldsites; he brought to the military an interest in natural history, in turn, the military shaped his science by facilitating further study, and by helping form a military attitude towards in his scientific work.

On leaving the military at twenty-one, Cott enrolled at the University of Cambridge to read theology. However, there was a change of direction when he undertook a university expedition to Brazil, under the direction of Cambridge zoologist Balfour Browne in 1923.³³ This expedition had an important impact on Cott, cementing his fervour for natural history and field observation. On return to Cambridge, Cott promptly donated some of the insect specimens collected to the University Zoology Museum and switched his studies to zoology.³⁴ Thereafter, when he could, Cott spent time in the field. A colleague recalled meeting him in the coffee room of the Zoology Department one grey afternoon and, on enquiring after him, Cott responded that he was looking forward to heading back soon to Africa because: 'there is just too much concrete in England'.³⁵

²⁹ K. Greer, Ornithology on "the Rock": territory, fieldwork, and the body in the Straits of Gibraltar in the mid nineteenth century, *Historical Geography* 37 (2009), 26-52.

³⁰ D. Livingstone, *Putting Science in its Place* (note 22), 183.

³¹ List of publications 1921-1960 (note 14).

³² S. Kirsch, Ecologists and the experimental landscape: the nature of science at the US Department of Energy's Savannah River Site, *cultural geographies*, 14. (2007). 485-510.

³³ Cambridge University Zoology Museum Archival Chronicles, 1923.

³⁴ Cambridge University Zoology Museum Archival Chronicles, 1923.

³⁵ Conversation with Ray Symonds, May 2008, a former student and colleague of Hugh Cott's.

Throughout his career, Cott travelled extensively in Africa, South America and in the Middle East, but there were two field trips in particular that significantly informed his biological study of camouflage. In September 1925 Cott went to the Lower Amazon for six months, and then in December 1926 he travelled to the Zambesi, in Africa, for nine months. Cott's field report from the Zambesi arguably offers the greatest insight into his working methods. The trip was a busy affair; he secured approximately five hundred living specimens for the Zoological Society, including puff adders, mambas, baboons, antelopes, warthogs, porcupines and many different species of birds.³⁶ Cott's report of the expedition to the Lower Amazon reveals a more personal engagement with science, describing an aesthetic, romantic response to fieldwork. Moreover, from both expeditions it is evident that the field is not only an ecological site, but also requires multiple cultural and social engagements. For example, in the Zambesi Cott relied upon access to field sites through the hospitality of the 'gentleman' who ran the Sena Sugar Estates and also acknowledged the support:

of my 'boy' – 'Jim' Majiwe; in the combined capacity in which he served me for many weeks as cook and interpreter, he was indispensable, while his honesty and the perpetual cheerfulness he showed under the most trying conditions will always be remembered with gratitude.³⁷

Camerini states that, when fieldwork is viewed as an object of study rather than solely as a means to produce scientific knowledge, what is uncovered is that it is a practice defined by its collective nature.³⁸ Cott realised the importance of becoming acquainted with the local community near his fieldsites. To capture a bird or a snake, he needed first to become familiar with the local human population before attending to the local natural environment. Cott acknowledged:

It will be understood from the outset that in an expedition of this nature the success which a collector obtains will depend to a very large extent upon the amount of help he receives from the natives in different localities in which he is working...On arriving at a new locality it was always, therefore, my first business to make the nature of my mission known to as great a number of the inhabitants as possible to enlist their interest, and to engage their assistance. The idea of a white man coming to Africa to collect snakes, lizards, and frogs seemed to them to be the utmost folly, never failing to arouse their curiosity, and was a never ending source of amusement; however, the news of a promised copper or two for specimens rapidly spread, and generally had the desired effect.³⁹

Once these matters had been addressed Cott could then turn his attention to the practicalities of field research. This required becoming acquainted with the field itself, for example, Cott's instructions on how to build a hide from which to observe animals.

³⁶ *Daily Telegraph*, Obituary 25th April 1987, pasted into Cott, H. *Adaptive Coloration in Animals* - CZM- Box 2.

³⁷ H. Cott, Report on the Zoological Society's expedition to the Zambesi, 1927, *Proceedings of the Zoological Society London*, (1929) 924.

³⁸ J. Camerini, Wallace in the field, *OSIRIS* 11 (1996) 46.

³⁹ H. Cott, Report on the Zoological Society's expedition to the Zambesi, (note 37), 944.

In a country where natives are expert at fieldcraft, there is no need to travel encumbered with a prefabricated hide. With local labour and local material a hide can be erected at short notice. With long experience of waiting and watching in hides overlooking crocodile rookeries I have found that it is a mistake to economize in space.⁴⁰

Cott explained that hide building also required becoming familiar with the local topography and the character of the surrounding wildlife. When settling on an agreeable spot for a hide a key factor was an easy escape route, because as he wrote one; ‘must be prepared for visitors such as hippo or elephant that may approach from any direction. It is useful to have knowledge of a climbable tree nearby’.⁴¹

It can be seen from Cott’s expedition that scientific practice is reliant upon a number of economic, social and professional networks, and also becomes enmeshed with various lines of human as well as nonhuman relations.

Once a suitably roomy hide was constructed, adjacent to an easily climbable tree, work in the field could begin. The scientist then must start to ‘grapple with the practical demands of collection’, which would often become a mix of established scientific practice and creative scientific craft.⁴² The field can be an unpredictable and troublesome place, as Cott discovered in the Zambesi. During the expedition collected living specimens were attacked by ants, termites and rats, there was also the issue of feeding the growing collection, the challenge of the climatic conditions and finding space to keep and transport the collection.⁴³

In response, Cott had to be inventive in securing the safe collection and passage of scientific specimens, for example, through the novel use of his violin case in providing temporary shelter for a snake (the fate of both the violin and reptile were not noted) or the employment of local boys in the role of look-outs in order to protect the expedition’s quarry. The distinct and unpredictable nature of each fieldwork site meant, as Kohler explains, that it was necessary for field biologists to refashion or devise new instruments specifically for their field needs.⁴⁴ On his expedition to the Zambesi, Cott hence found that capturing species required tools purposely designed for fieldwork, as well as the innovative use of more prosaic objects which took on new roles:

⁴⁰ H. Cott, *Looking at Animals*, (note 3), 192.

⁴¹ H. Cott, *Looking at Animals*, (note 3), 192.

⁴² J. Camerini, Wallace in the field, (note 38), 48.

⁴³ H. Cott, Report on the Zoological Society’s expedition to the Zambesi, (note 37), 948.

⁴⁴ R. Kohler, *Landscapes and Labscapes, Exploring the Lab-Field Border in Biology*, Chicago, 2002.

...a 'snake-pole' fitted with an adjustable leather noose was supplied to me by Miss J. B. Procter and proved quite invaluable. A thick pair of motoring gauntlets also turned out to be very useful when holding smaller species likely to have been damaged by the snake pole.⁴⁵

From Cott's account of fieldwork in the Zambesi, we can begin to sense the creative and at times scrappy nature of scientific practice. Practical problems require novel solutions, objects are required to be malleable in their use, and scientists are required to respond to the demands of their fieldsite and the local environment. Cott became trained in this practical method of scientific enquiry, whereby it was essential to experience the field, to be sensually embedded in the natural world. For Cott, empirical work needed to be performed in site and in place, meaning that for him the geography of his science mattered greatly:⁴⁶

Cott had an under-riding belief that you had to be there in person and see it for yourself which was more valuable than recording datasets. He was a field naturalist, a trained hunter-gather almost.⁴⁷

The aesthetics of fieldwork

The field, for Cott, was not just the location of science; it was also a place that inspired awe and wonder. Fieldwork experiences stimulated the particular nature of his scientific knowledge which was, in turn, shaped by his embodied engagement with nature in the field. In his report of the expedition to the Lower Amazon, Cott mingled scientific writing with lyrical prose in an attempt to convey the experience of *being* in the field:

In the entire world, the Amazon valley is unique as regards the vast and unbroken extent of its mighty rain forests. The wonderful luxuriance of their vegetation, and the abundance, variety and gorgeous beauty of their peculiarly, interesting animal population combine to make the region a biologist's paradise, ... Silence reigns here, and a dense roof of foliage darkens the forest with a perpetual gloom, which few rays of sunlight can penetrate. The oppressive atmosphere, the sombre stillness, the indescribably grandeur and solemnity of the scene, all impress the traveller with a sense of wonder and admiration, not unmixed with awe.⁴⁸

From this account of the Amazon valley, Cott describes how he is moved by the sensuality of the experience. Kuklick and Kohler suggest that fieldsites are ambiguous places with porous boundaries, which can be breached or transgressed, making them interesting and creative places: 'Experiences of natural places define the field sciences. Field scientists experience places largely through work, although the lines between work and leisure, between production and consumption, are less clearly marked in the field than in many social arenas'.⁴⁹ Yet, Matless and

⁴⁵ H. Cott, Report on the Zoological Society's expedition to the Zambesi, (note 37), 948.

⁴⁶ D. Stoddart *On Geography and Its History*, Oxford, 1986.

⁴⁷ Conversation with Stephen Tompkins.

⁴⁸ H. Cott, The natural history of the Lower Amazon, *Proceedings of the British Naturalist Society*, 7 (1930),181.

⁴⁹ H. Kuklick, R. Kohler, Introduction, *OSIRIS* 11 (1996) 14.

Cameron have critiqued this particular ‘place-centred’ approach claiming it ignores the notion of place as a ‘network of relations’, which inform how field sites are engaged with and in.⁵⁰ Studying Cott’s engagement with the field reveals that the places of his research were not only shaped through numerous networks of social, professional and nonhuman relations, but also by the blurring of identities - the scientist with the awed traveller, and romantic artist. For Cott, the field did not engender a ‘neat division between science and romanticism’, but brought into focus the multiple, mingling selves that shaped his fieldwork and science.⁵¹

Further, reflecting on his expeditions, Cott explained that the experience of field research extended beyond specific or fixed sites; field research was a process of travelling to and through place. It was this notion of space that awoke the keen observer in Cott:

Opportunities for travel are greater today than ever before. With less discomfort and difficulty we can go faster and further. But speed and distance are only means to an end. The essence of travel is not in hurrying from place to place; its rewards come through the enlargement of our capacity for appreciation. The successful traveller is more than a mere spectator: he feels part of the soil and scene – as one who is a citizen of the world. And the passing stranger has the advantage over the resident, for every impression that to the one is new with the stimulus of surprise and delight, to the other has grown stale through familiarity.⁵²

Cott became corporeally connected to his science through the processing of travelling; ‘natural history knowledge-gathering was inseparable from the movement through space, inseparable then from bodily involvement’.⁵³ His experiences of travelling echo Ingold’s discourse of the walk, as a way of making sense of how people inhabit their environments. Ingold describes how the traveller and the line both trace through space and become one and the same thing: ‘it is a line that advances from the tip as he presses on in an ongoing process of growth and development, or of self-renewal’.⁵⁴ This discourse allows for the intimate experience of travelling through space to be articulated as a process which shapes impressions of the sites of scientific activity, and Cott’s contribution to camouflage knowledge can be studied through tracing scientific journeys, sites and spaces. By attending to fieldsites, an historical and geographical study of fieldwork becomes a spatial and temporal investigation into networks of relations and scientific practice. When considering the ways in which Alfred Russell Wallace’s contribution to science was informed by his field experience, Camerini states: ‘His experiences in the field changed him from an inexperienced collector, smitten with natural history, into a committed and

⁵⁰ L. Cameron and D. Matless, *Translocal ecologies*, (note 10), 16.

⁵¹ B. Hevly, *Heroic Science*, (note 15), 84.

⁵² H. Cott, *Uganda in Black and White*, (note 2), xx.

⁵³ D. Outram, *New Spaces in Natural History*, in: N. Jardine, J.A. Secord, E.C. Spary, (Eds) *Culture of Natural History* 1996 255.

⁵⁴ T. Ingold, *Lines*, (note 6), 75-76.

well-published naturalist'.⁵⁵ This sentiment could be equally applied to Cott's scientific career where the pursuit of amateur natural history led him to academic scientific study through his passion and embodied engagement with the field.

Observing the obscure

For Cott, travelling helped him to inhabit environments and, therefore, to observe nature more closely: 'Cott watched and watched and watched and wrote as Darwin would have done. He would have scorned the quantitative work that is now being done'.⁵⁶

It was this keen interest in watching and observing that embodied Cott's approach to scientific research. He explains the supremacy of observation to his science;

In a country like Brazil, where a naturalist is confronted with animal life in such endless variety, there is a temptation for him to become simply a "collector" and to devote his time to capturing and preserving specimens rather than to observing the life-habits of the living creatures in their natural haunts.⁵⁷

Kohler explains that: 'Darwin was the exemplary scientific naturalist, who worked out of doors and observed so well that observation was as good as experiment'.⁵⁸ This close attention to observation was the true skill of Cott's science, from the hide studying how animals effectively enrol their bodies so they become one with landscape required Cott's own body to become enrolled in his surrounding environ. Daston and Lunbeck explain scientific observation as a process engaging 'body and mind, material props, techniques of description and visualization' in an experience which 'has been shaped and sharpened to scientific ends'.⁵⁹ Observation led Cott to note there was often a disjuncture between material reality and what was observed. Vision, he realised, is produced through a relationship between physics, physiology and psychology; what happens in the world, the physiological reactions which occurs within the eye as it observes, and what sense the brain makes of this information.⁶⁰ Hence:

Most of us make a mental reservation, based upon long years of experience, and we reject the evidence of the senses. Leaves, we know, are green in summer, not golden; and unless we are especially observant or specially trained, we refuse to see that the distant firs are pale grey, or that the snow on the hills is blue.⁶¹

Cott proposed that the process by which we recognise and interpret the visual world around us is fourfold. Firstly, an object is observed as separate from its surroundings by its colour, which

⁵⁵ J. Camerini, Wallace in the field (note 38), 64.

⁵⁶ Conversation with Stephen Tomkins.

⁵⁷ H. Cott, Observations on the life-habits of some Batrachians and reptiles from the Lower Amazon: and a note on some mammals from Marajo Island, *Proceedings of the Zoological Society of London*, (1926), 1176.

⁵⁸ R. Kohler, *Landscapes and Labscapes*, (note 44), 33.

⁵⁹ L. Daston and E. Lunbeck, Observation observed, (note 21), 2-3.

⁶⁰ H. Cott, *Adaptive Coloration in Animals*, (note 1), 3.

⁶¹ H. Cott, *Adaptive Coloration in Animals*, (note 1), 2.

differs in depth and hue; secondly, an object is revealed by its relief; light and shade disclose to the eye texture. Thirdly, although an object is not bound by outlines, its form is exposed by its contour ‘which divides the area where it is from the area where it is not in the visual field’;⁶² fourthly, the shadows cast by an object render it conspicuous from its background. Cott proclaimed that; ‘Actually, we *see* nothing but flat stains of colour – variously shaded and variously shaped’.⁶³

Hence, adaptive colourations in animals work to undermine the appearance of things through patterning, form and behaviour. However, to observe the intricacies of these techniques with the naked eye alone was not particularly easy or reliable and the camera as recording instrument became a vital piece of technology in the field allowing Cott to more precisely capture the vision of things (fig. 5). The combined use of the eye and the camera could produce a permanent documentation of the environment precisely and in great detail. Therefore, the ‘scientific experience is, so to speak, an instrument-body hybrid’.⁶⁴ In the field this blurring of scientific body with scientific instrument ‘to extend and calibrate sense impressions’ did not eliminate that ‘what the explorer saw himself was crucial to establishing the truth-status of his observations’; Cott still mediated how his photography should be read and what scientific truths his work was disclosing.⁶⁵

Indeed:

When properly used the camera discloses – in a way unrivalled by any other medium – a world of surprising beauty in common things: and a good photographic record will have pictorial qualities, as well as technical merit and scientific interest.⁶⁶

Cott’s field practices reveal that the scientific and the technological, the artistic and the emotional, are never clearly discrete, but instead are folded into one another. The field expeditions examined here framed Cott as biological expert on camouflage, and subsequently accomplished military camoufleur. Throughout his academic and military careers, a passion for the field endured. Although he would become out of step with disciplinary methods, Cott’s attitude to science discloses the sensual, active, practical, technological and social character of fieldwork and knowledge production. It was this approach that led Cott to rely on his senses and physical presence within and through places; for Cott, this *was* scientific rigour. Observation

⁶² H. Cott, *Adaptive Coloration in Animals*, (note 1),4.

⁶³ H. Cott, *Adaptive Coloration in Animals*, (note 1),3.

⁶⁴ V. Despret, The Body We Care For: Figures of Anthro-zoo-genesis, *Body & Society* 10 (2004) 111-134.

⁶⁵ Outram, On Being Perseus (note 16), 283.

⁶⁶ H. Cott, *Zoological Photography in Practice: A Contribution to the Technique and Art of Wild Animal Portraiture*, London, 1956, 135.

became the fundamental method of Cott's science and these expeditions became hugely influential, their findings and analysis the basis for his 1940 book *Adaptive Coloration in Animals*, which extended ideas coursing through British zoology on the subject of camouflage, becoming a seminal text on the subject, and in the Second World War a core text for camouflage training in the British military.

Communicating camouflage

From the field to finished publication, *Adaptive Coloration in Animals* took over a decade to complete, and throughout this period Cott's scientific findings underwent a process of transformation. Alberti has reflected how museum objects undergo a 'sleight of hand' whereby a sense of stability and completeness is established upon them.⁶⁷ Cott's book, as an object of scientific knowledge, through its structure, lay-out, tone and binding, underwent a similar process whereby his science was fixed and imbued with an objective, authoritative quality. Livingstone muses: 'All this opens up interesting questions about the movement of text from raw, thumb-imprinted scratches on rain-spattered sheets to the cultivated immediacy of the printed page'.⁶⁸ As a result, *Adaptive Coloration in Animals*, from the field to publishing house, saw Cott's science smoothed and his creative methods of scientific practice muted. An objective tone pervades and his research is presented as a completed and sealed area of scientific study, working to establish Cott as an authoritative figure on the subject.

The means by which Cott communicated his camouflage findings in *Adaptive Coloration in Animals* was by the accompaniment of his textual explanations with visual examples, such as his field photographs and illustrations. Ryan has discussed the ways in which visual devices act to legitimise particular forms of knowledge.⁶⁹ The use of photography - and arguably scientific illustrations to an even greater extent - did not guarantee the fidelity of observation, images were framed by conventions, reworked to reveal the specifics of the scientific knowledge under production.⁷⁰ As Domosh states, visual materials are 'discursive forms' which participate in the 'creation of meaning',⁷¹ and the photographs and illustrations in *Adaptive Coloration in Animals* enrolled 'the nonhuman body in co-creating the ideologies and placings afforded to it, asserting it

⁶⁷ S. Alberti, *Nature and Culture: Objects, Disciplines and the Manchester Museum*, Manchester, 2009, 123-144.

⁶⁸ D. Livingstone, Text, talk and testimony: geographical reflections on scientific habits. An afterword, *British Journal for the History of Science* 38 (2005), 9.

⁶⁹ J. Ryan, Who's afraid of visual culture, *Antipode*, 35 (2003), 232-237.

⁷⁰ J. Ryan, Views in a warm climate: reflections on images of the tropics, *Singapore Journal of Tropical Geography*, 25, (2004), 18-22.

⁷¹ M. Domosh, Visual texts in historical geography, *Historical Geography*, 29, (2001), 68.

as a presence'.⁷² Thus, Cott's incorporation of visual imagery into his scientific text was a means to demonstrate and legitimise his knowledge claims.

Yet, visual material was not the only technique employed by Cott to encourage the reader of the sure status of his scientific findings on camouflage. He also permeated the book with analogies between concealment in nature and relatable examples in modern society; he drew on the mundane qualities of the net curtain, the ubiquitous symbol of English suburbia:

In general, very light markings on a dark object, and very dark markings on a light one, will be most effective. The principle is similar to that which makes an open network curtain effective as a screen in preventing a casual passer-by from seeing into the interior of a room ... details in the room beyond are openly exposed to view – although they cannot be seen clearly.⁷³

However, most of the parallels that Cott invoked were comparisons between camouflage in nature and camouflage in modern warfare. He observed:

This book was written in a period of unsettled peace, in which the nations of Europe were preparing for, or against, war. Now the war has come, and with it the intensification of industrial energy and of that preoccupation with machines which has long been an accompaniment of modern life. In these days that lie ahead, when too exclusive an interest in mechanical and scientific contrivances must tend to encourage the development of what Lord Dawson once called the 'gadget-mind', which is restless, unreflective, and unemotional, the study of natural history provides a welcome antidote – not indeed as a way of escape from reality, but rather as a means of seeing, as from a mountain-top, and in clearer and wider perspective, that struggle for existence which is the lot of men not less than of animals.⁷⁴

Adaptive Coloration in Animals can duly be read not only as a work of natural history, but also as a manifesto for applying biological principles of camouflage in the development of modern military camouflage, suggesting that technological innovations required reflection and scrutiny and that war required a close even emotional evaluation of the nature of conflict.

Transferring the biological to the technological

In the late 1930s as war drew closer, Cott was active in approaching the military to promote his skills in developing military camouflage. His first step was to give a lecture to the Royal Engineers at Chatham in October 1938, published in the *Royal Engineers Journal* in December that year, allowing for Cott's ideas on camouflage to be circulated widely through the military. Throughout the lecture, Cott laid out his blueprint for the biological principles of camouflage in nature to be effectively transferred to military technology:

⁷² C. Johnston, Beyond the clearing: towards a dwelt animal geography, *Progress in Human Geography* 32 (2008) 363

⁷³ H. Cott, *Adaptive Coloration in Animals*, (note 1), 51.

⁷⁴ H. Cott, *Adaptive Coloration in Animals*, (note 1), xv.

It is my intention to describe the optical principles upon which concealment depends: to indicate the methods by which this end has been achieved in nature: and to refer to the bearing of these principles and devices upon the important problem of applied camouflage.⁷⁵

Cott emphasised the importance of looking to nature to find answers to the conundrums of modern military camouflage against increasingly sophisticated and effective weapons such as aerial observation and bombing, reflecting: 'In this sphere of visual concealment different wild animals have attained a degree of perfection far beyond the comparatively clumsy attempts at camouflage with which we are too easily satisfied'.⁷⁶

This was just one of Cott's numerous attempts to become 'utilised' by the military, his next step was to demonstrate his skills and scientific principles through a camouflage experiment on a military installation. In the early summer of 1939, Cott persuaded the military to allow him to camouflage an aerodrome at Mildenhall for their inspection:

All the aerodromes I have seen are glaringly conspicuous. At Mildenhall the hangars are made of redbrick, and have a serrated roof-structure which can catch the eye from great distances. And of course the landing grounds stand out on account of their great extent of unbroken green.⁷⁷

Cott devoted much time, enthusiasm, and expertise to this experiment, returning to his field observations he noted that to effectively camouflage he must consider:

four fundamental steps towards effective concealment must lie in the directions (1) of colour resemblance – or in the agreement in colour and tone between the object and its background; (2) the obliterative shading – a system of counterlightening and darkening which abolishes the appearance of relief caused by the effects of light and shade; (3) the disruptive coloration – or the use of superimposed pattern of contrasted colours and tones which serve to break up surface continuity and to blur the outline; and (4) of shadow elimination – the screening or effacement of cast shadows by orientation or by structural means.⁷⁸

His completed camouflage scheme received praise from several quarters in the military, including Mildenhall's Station Commander and Sir Ernest Swinton, who would be the first chair of the Advisory Panel in Camouflage.⁷⁹ The war artist Eric Kennington after seeing Cott's camouflage aerodrome wrote to him:⁸⁰

I have come from Mildenhall. It does you credit. It's not bombed at all, and no doubt it would be if it was more obvious. The pilots say they have great difficulty returning to it. You did a grand job, and a lot of young men are completely at ease there between their bouts of activity.⁸¹

⁷⁵ H. Cott, *Camouflage in nature and in war*, *The Royal Engineers Journal*, (1938), 1 – CZM Box 2.

⁷⁶ H. Cott, *Camouflage in nature and in war*, (note 76), 1.

⁷⁷ Letter from Cott to Kerr, 16th of April 1939 – GUA DC6/709.

⁷⁸ H. Cott, *Camouflage*, *The Advancement of Science* IV, (1948), 301.

⁷⁹ Letter from Swinton to Kerr, 27th September 1941 – GUA DC6/443.

⁸⁰ Letter from Swinton to Kerr, 27th September 1941 – GUA DC6/443.

⁸¹ Letter from Kennington to Cott, 9th December 1940 – GUA DC6/761.

However, after an inspection of his work, it was perceived by the military that Cott's scheme was impractical. To replicate elsewhere, it was stated, would be too time and labour intensive, requiring specialist skills, and therefore, ultimately too expensive.⁸²

Yet, as the need for concealment had become more pressing by 1940, the military decided to employ Cott to develop their camouflage technology. He was enrolled on the Royal Engineers inaugural course of the Camouflage Development and Training Centre (CD&TC) at Farnham Castle. Approximately thirty men with expertise in visuality and aesthetics were chosen to attend the first course; the arts were represented by surrealist painters Julian Trevelyan and Ronald Penrose, designers Steven Sykes and Ashley Havinden, as well as stained-glass artists, filmmakers such as Geoffrey Barkas, a cartoonist, a surrealist poet and a restorer of religious art.⁸³ This cast was completed by the well-known stage magician and conjuror Jasper Maskelyne.⁸⁴ Other disciplines were also drawn upon, including architecture and engineering.⁸⁵ Cott found himself the only scientist amongst this group and also the only one with previous military experience, the latter, he was pleased to note, seeing him exalted to Senior Officer.⁸⁶

Cott's expertise and its particular application to warfare was soon ascertained by his fellow camouflage trainees, and Trevelyan's relationship with Cott offers an example of the collaborative environment fostered at the CD&TC:

There was also a distinguished Cambridge zoologist, Dr Hugh Cott, who had written the most authoritative study on the protective coloration of animals and who now applied the principles he found in the animal kingdom to the disguise of guns and tanks. We laughed at him for his passionate addiction of counter-shading, the trick by which, for instance, the white belly and dark back of a gazelle, when seen at a distance in strong light, seem to flatten out and destroy form.⁸⁷

Hence, Farnham Castle can be viewed as a site where the entanglement of science, art and the military was embraced and put to work innovating camouflage design and technology. For example, Trevelyan recalled the forging of interdisciplinary knowledge in camouflage design:

Occasionally I would be asked to give a demonstration of how to paint some piece of equipment so as to merge it with the broken country around it. I would arrive at the barrack square with pots of paint and brushes, and set to work daubing the shield of some anti-tank gun with spots of different greens and browns, touching the underside of the barrel itself with pure white on the principles of Dr Cott's gazelles. Against the dreary barrack walls it looked an unholy mess, but when it was wheeled out into the country and placed against the hedge, there were cries of astonishment at my magic.⁸⁸

⁸² Letter from Cott to Kerr, 9th June 1939 – GUA DC6/712.

⁸³ D. Fisher, *The War Magician*, London, 1983, 17.

⁸⁴ D. Fisher, *The War Magician*, London, 1983, 17.

⁸⁵ Letter from Cott to Kerr, 26th October, 1940 – GUA DC6/758.

⁸⁶ Letter from Cott to Kerr, 26th October, 1940, (note 85).

⁸⁷ J. Trevelyan, *Indigo Days*, London, 1957, 118.

⁸⁸ J. Trevelyan, *Indigo Days*, (note 87), 130.

Thus, Farnham was a dialogic space, fostered by the military in the Second World War for the development of camouflage. It led Cott and many others at the CD&TC to ply their trade in the art and science of concealment and disguise in the desert plains of the Middle East. However, as Cott recalled when he was sent to the Desert War, Camouflage Officers were not always met with enthusiasm from other military quarters:

When in early 1941 I took up my first service appointment, the Brigadier to whom I reported to duty welcomed me with these words – he said: ‘A camouflage officer is as much use to me as a refrigerator at the north pole’. It happened that we were nowhere near the north pole, but in Africa, where a refrigerator would have been a very useful piece of equipment. However, I was not unduly discouraged by this somewhat chilly reception.⁸⁹

Yet, camouflage and the camoufleurs proved their worth in the desert. A review of the Second World War camouflage and its effectiveness concluded; ‘The story of visual deception schemes as practised in the varying theatres of war, started in the Middle East’.⁹⁰

And desert camouflage’s use was hailed as victory in the highest quarters:

I need hardly remind you of Mr Winston Churchill’s words, when he told the House of Commons after the battle: ‘A complete tactical surprise was achieved in the Western Desert by a marvellous system of camouflage’.⁹¹

Soon camouflage innovated by British Camouflage Officers of the CD&TC was deployed across the various battlefields of the Second World War. Cott became Chief Instructor at the Middle East Camouflage Training School and later served in Lebanon at the Mountain Warfare Training Centre, where he taught soldiers the principles of both biological and military camouflage, the two indelibly linked in Cott’s practice, although nature still in Cott’s view had the upper hand, he proclaimed; ‘To sum up: we have seen that there exist certain well-defined scientific principles of camouflage – many of them derived from research in biology’.⁹²

The history of camouflage narrated through Cott’s scientific biography is revealed it to be an entanglement of science, art, human and nonhuman relations in the field. Further, Cott offers a sightline into the military-artistic-scientific complex of the Second World War through his appreciation of the art of his science and the importance of the biological to the technological.

Conclusion

⁸⁹ H. Cott, Camouflage, *The Advancement of Science* (IV) 1948, 308.

⁹⁰ D. Wiseman, *The Second World War 1939–1945 Army Special Weapons and Types of Warfare, Volume III: Visual and Sonic Warfare*, London, 1953, 40.

⁹¹ H. Cott, Camouflage, (note 89), 308.

⁹² H. Cott, Camouflage (note 89), 308.

Cott's art-work provides one means of understanding his science. His illustrations embody several aspects of his scientific life: they serve simultaneously as claims to scientific authority, visual accounts of witnessing place, testimony to an embodied and creative engagement with nature, and evidence of an entangled relationship between fieldsite and battlefield. These images reveal a mingling of selves, skills and knowledge in the pursuit of science

(Fig. 5). Starting with this close consideration of Cott's art this paper has considered the craft and aesthetics of fieldwork, and has highlighted the potential of using a biographical approach to explore the cultural geography of science. By using Cott's accounts of his expeditions to the Zambesi and the Amazon, which document his scientific practices in detail, we can understand the field not as a hermetically sealed site, but always a composite hybrid space, filled with human and nonhuman relations, and, for Cott, engaged with through an artistic eye, military precision and scientific rigour. Cott's contribution to military camouflage also reveals his fieldwork technique of blending scientific observation with aesthetic visualisations, leading him to realise the potential of biological camouflage beyond the scientific, and blending into wider socio-political relations.

Science is performed in multiple places and is produced through hybrid networks of people, practices, objects, aesthetics and politics. It is through the study of Cott's fieldwork the ways in which scientific knowledge diffuses through multiple spaces, how it travels, alters and transforms through complex relations between the socio-political, personal, material and nonhuman can most fully be described. For Cott, the field was where his science began, it enrolled him in artistic practices and technological innovations, engaged him in human and nonhuman relations, and ultimately led him to war. Cott's fieldwork shaped his science and his self, leaving him to reflect: 'Looking back on these wanderings, I cannot help thinking, first and last, of work done in the field'⁹³.

⁹³H. Cott, *Zoological Photography*, (note 66), 24.