18TH CENTURY TIMES OF NATURE

Cultural Techniques in Gilbert White's Natural History

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Summary

This paper is an examination of Gilbert White's practice of making natural history which took place in the latter half of the 18th-century. White's knowledge project concerned itself mainly with the issue of natural rhythms; the migration patterns of birds, indications of spring, and differences in blooming times in different plants and flowers. It was thus a concern with nature which was particularly temporal. This concern was further situated within a broader effort in Britain at the time to create calendars of nature. In working towards this goal, which among other things involved ascertaining the punctuality of natural rhythms, Gilbert White used a printed journal, titled *The Naturalist's Journal*, with a lay-out based on a lattice-grid, in order to record natural events. The argument of this paper is that this was a material-semiotic practice whose effects were not only epistemological. By applying the media theoretical concept of cultural techniques to Gilbert White's knowledge practice, I argue that it becomes possible to show how time was constituted in a specific way through the use of the journal. Through the actor-network which was its condition of possibility, the times of nature were rendered as precise rather than approximate, and became legible as an array of detached animal, insect and plant events which could be inscribed, transported, aggregated and viewed at a glance.

I further argue that these acts of rendering and making legible were the outcome of five cultural techniques which became blackboxed in the use of the *Journal*. By unblackboxing the *Journal*, I claim that it is possible to show how it operated upon the phenomena it purported to represent, and ultimately what consequences it had concerning the times of nature. However, I also argue that cultural techniques only become operational by being circulated through culturally and historically specific circuits, and so a crucial part of unpacking the work of cultural techniques involves a thorough contextualization of the social context.

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Finally, I want to give a big thanks to my mentors and guides at the masters programme in European Culture; Anne Eriksen, Ellen Krefting, Line Cecilie Engh and John Ødemark. Your instruction and advice has been invaluable during my journey into the field of history of knowledge.

Spending over a 1000 hours in front of a keyboard and a screen attempting to complete a seemingly endless assignment about a bunch of things that happened a very long time ago is by most accounts a perfectly bizarre endeavor. My only excuses are that I enjoyed it immensely and believe it to hold some importance.

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1. Introduction

Who was Gilbert White?

Gilbert White was born at Selborne, a small village in South East England, on the 18th of July, 1720. His grandfather was the local parson. It comes as no surprise, then, that White would pursue the very same profession. Some years after having gotten his degree in theology at Oriel College, Oxford, he would settle down at the family estate in Selborne, though fulfilling his vicarage duties in nearby villages, and devote himself fully to the meticulous and careful observation and writing of his local surroundings until his death in 1793. His lifelong dedication to observation of nature eventually culminated in the publication of *The Natural History of Selborne* in 1789, a work which came to echo through British imaginaries of nature for centuries, influencing people like Coleridge, Darwin, and Thoreau, and never going out of print since it came out. The book grew out of a series of letters exchanged with the Welsh naturalist Thomas Pennant, who published several notable works of natural history in the 18th-century, namely, *British Zoology* in 1776 and *Arctic Zoology* in 1784-87, and with the lawyer, antiquarian and naturalist Daines Barrington, a fellow of the Royal Society, and an avid writer for the Society's journal, *Philosophical Transactions*.

These letters, written between 1767 and 1787, form the main body of the work. The first part comprises the 44 letters White wrote to Pennant, and the second part comprises his 66 letters to Barrington. Gilbert White also included a section in *A Natural History of Selborne* on what he called antiquites, a term which we might think of as involving an attempt to engage systematically with remnants from the past, seeing as he thought that natural history should not separate between what he called "natural occurrences" and antiquities, and so the book comprises 26 fictional letters regarding mostly the ecclesiastical history of the region.

Source Material and Research Literature

Apart from the main work *The Natural History of Selborne* (referred to from here on as *Selborne)*, which I have accessed in the form of the 1877 edition edited by Thomas Bell, which comprises two volumes, the second of which also includes several other personal letters, sermons, and his account-books, there are the records he made in his journals. Gilbert White was a meticulous journaler, and these records are my primary interest in this thesis.

First there are the records he kept in the *Garden Kalendar* between 1751 and 1768, and then there are the records he kept in the *Naturalist's Journal* from 1768 to 1793. I have primarily had access to these through the edited volume by Francesca Greenoak, published between 1986 and 1989, which includes a transcription of all of White's records (Greenoak 1986-89). I have, however, only had access to volume one and two of the series, rendering the years between 1783 and 1793 unavailable in print form. For these years I have had to turn to the transcription of the journals made available online.[1] The notable difference between the two sources is that the edited volumes by Greenoak include thermometer and barometric readings, weather descriptions, as well as records that were made in the three columns regarding plants, birds and insects, whereas the digital transcription only conveys what was represented in the "Miscellaneous" column. Recently the original manuscript for *Selborne* has also been made available online.[2] This has been an invaluable resource in my research.

There has been a lot written about Gilbert White from a perspective of literary history (Lipscomb 2007, King 2019, Sodeman 2020). There have also been recent additions to White scholarship which seek to situate White within the knowledge-historical context of his time (Secord 2013, Rose 2019). Interesting work has also been done tracing the roots of biodiversity accounting back to White (Marous & Atkins 2020). While these works are undoubtedly important and useful, I have not worked closely with them in my own research. White has also had the privilege of having many biographers (Holt-White 1901, Johnson 1928, Mabey 1986, Foster 1988, Dadswell 2019). In this thesis, I have consulted the works of Foster and Dadswell. Seeing as this thesis is limited in scope, and my aim has been to account for the ontological implications of White's scientific practice, and to analyze it using the concept of cultural techniques, there is a lot of scholarship regarding White that will go untreated.

Theory and Method

Gilbert White had a particular knowledge project, a particular set of questions, pertaining to the recurring periodicities of nature, whose precision and regularity baffled him, and whose elucidation was his main preoccupation. While *Natural History of Selborne* sheds light on many different issues, from the place of earthworms in the economy of nature, to the question of whether maternal affection is a natural instinct in animals, the issue of nature's periodicities constitutes the soul of the work. In his attempt to develop an understanding of

[1] For more information, see http://naturalhistoryofselborne.com/
[2] For more information, see https://www.gilbertwhiteshouse.org.uk/manuscript/

the rhythms of nature, he followed certain procedures. Here I want to argue that White's procedure needs unpacking on two levels. In the first instance, there were the principles which informed his work as more or less explicitly stated by White himself. These principles were in turn informed by values and ideals permeating the field of natural history in the 18th-century. They grew out of the larger context of natural history in early modern England. Understanding this context holds an important key to understanding what Gilbert White was up to, and why he chose to work the way he did. Thus by taking into account the larger material and social contexts of White's work, I will approach his practice in part 1 of this thesis first and foremost through a contextualization of his writings. Following the recent turn in history toward a history of knowledge, I will take a broader perspective on White's natural science, taking into account practices, technologies, social and infrastructural networks and publishing contexts. This will also serve to lay the groundwork for the media theoretical analysis that follows in part 2. This thesis thus has two parts, where the second builds on the first, in the sense that part 1 lays out some of the broader context for what I talk about in part 2.

In the second instance, his procedures can be understood on the level of utterly concrete actions, or as chains of operations, in which tools, concepts and things coalesce in series of iterations. On the face of it actions such as writing things down or observing birds may seem mundane and ordinary. What is so special, after all, about entering data into a table? But it is precisely because they've slipped into the background of our perception that we must investigate them more closely. An example of what I'm talking about is that White had a habit of carrying pieces of paper with him into the field on which he would write down the name of birds who were heard to be singing. A small and insignificant circumstance at first sight indeed. But a major part of White's scientific practice involved creating paper artifacts. And if he wasn't creating them, he was acquiring them, consulting them, comparing them, or moving them around, whether far away to his brother, a naturalist-parson stationed in Gibraltar, or nearby to his fellow naturalist colleagues in Britain. In essence, what really underpinned White's investigative efforts were particular ways of handling paper. Paper artifacts served as the mediating envoys between his own experiences, fleeting and ephemeral as they were, the natural world at large, and the wider network of British naturalists. This particular kind of paper-based action, at once material and semiotic, has the peculiar

affordance of negating limitations imposed by space and time.[3] His letters sent to his naturalist colleagues around the country conjured White's presence in distant locations.[4] His paper-slips inscribed with latin names of birds invoked the presence of those birds long after they had appeared. His journal formed a map of visual, spatialized time, which grafted the positions of plants, animals and insects onto a physical grid-based medium, thus allowing the triangulation of their location. This medium then became an access-point through which greater spans of time could be apprehended than by cognition alone. These pieces of paper, then, these mute and inanimate objects, be they journal pages or paper slips, were making things happen. They were doing things. And more importantly, they were doing things to time.

This way of conceiving scientific practice draws upon recent attempts to theorize the recursive dynamic between the symbolic and the material in media practices, taking place both in the tradition of German media theory based on the concept of cultural techniques (Siegert 2015a, Wickerberg 2018), as well as within the field of actor-network theory (Latour 2013, Latour & Woolgar 1986), and in other writings (Peters 2015, Hobart & Schiffman 1998). One of the strengths of these approaches is that they defamiliarize commonplace practices and make them come into view more clearly. It is a way of harnessing the power of estrangement as an analytical device (Eriksen 2007). Once they have emerged out of the background of the taken-for-granted, they can be properly historicized and their implications assessed. I argue that by drawing together these approaches, which pay close attention to the materiality of ontologization, to borrow a term from the media theorist Geoffrey Winthrop-Young, it becomes possible to consider what part White's practice of recording nature events played in the process of constituting time (Siegert 2018). The notion that material-semiotic practices enact ontological distinctions is one of the central arguments of this thesis. Thus after White's scientific practice has been thoroughly contextualized, which is the aim of part 1, I will begin to analyze the *Naturalist's Journal* which was situated within a broader move in British natural history to create calendars of nature in the 1750's and 60's. Part 2, then, uses the theory of cultural techniques to show how time was changed and operated upon through the use of the *Journal.*

[3] From a cognitive science perspective, the footnote is an interesting time-transcending tool afforded by information technology. As is often the case, longer footnotes are added after the paragraph or sentence to which they are attached were written. Thus a footnote is able to connect an author's past state with a present state.
[4] The concept of writing as a medium of presence is inspired by Wickberg's reading of Gumbrecht in his doctoral thesis *Pellucid Paper.* See Wickberg 2018, 16.

Cultural Techniques for Making the Times of Nature Available

> "There is no 'man' independent from cultural techniques of hominization, or anthropotechnics; there is no time independent from the cultural techniques of calendars, time measurement and synchronization; there is no space independent from cultural techniques of ruling spaces[...]."
>
> - Bernhard Siegert, *The Map is the Territory* (Siegert 2011)

What does it mean to say that there is no time independent of calendars? How can calendars, as John Durham Peters claims, constitute time in describing it (Peters 2015)? Questions such as these indicate a different way of approaching the phenomena of time. It does not involve a recourse to physics and the complex equations of which it is constituted. Neither does it involve a metaphysical discussion of the essence of time. As Siegert claims, "There is no essence of time; there are only techniques of measuring time and synchronicity that make time available[...] "(Siegert 2015b). Siegert's approach, then, is "one that questions the constitutive effects of inconspicuous cultural techniques as they relate to the basis of large philosophical concepts"(ibid.).

Instead of asking "what is time?", one can then proceed to look at how time is made available in a historically contingent configuration of elements and processes. This necessarily directs one's gaze toward a wider array of phenomena; not only toward texts, concepts, practices or technologies, but to their interplay and mutual constitution. To speak about cultural techniques is to speak about operative chains which conjoin subjects, things and procedures. While the first phase of German media theory was positively antihermeneutic, seeking to redress the technophobia of postwar German intellectual culture by attempting to drive, as Kittler once stated, *das Geistes* out of *den Geisteswissenschaften*, which involved a programmatic recourse to instruments, machinery, inscriptions and institutions, the second phase of German media theory, which started to come into its own during the 90s, was positively posthermeneutic, and turned its attention to the "materiality/exteriority of the signifier"(Siegert 2015a, 3; Geoghegan 2013). What becomes the object of study, then, is a "historically given micronetwork of technologies and techniques", or, in other words, "a more or less complex actor-network that comprises technological objects as well as the operative chains they are part of and that configure or constitute them"(Siegert 2015a, 11).

There are two things in particular which I find useful about this concept for the purpose of understanding how the *Journal* constitutes time. The first is that it has an integrative view of phenomena as a built-in feature. Through its insistence on "chains of operations" it bypasses trite dichotomies which have long outplayed their usefulness. It focuses instead on series of iterations which traverse elements belonging to disparate domains. This bears on an argument made by the historian of knowledge Jurgen Renn. In *Evolution of Knowledge*, Renn makes the claim that knowledge is always cognitive, material and social (Renn 2020). I would add to this that it is always cognitive, material and social not at different times or in distinct steps, but simultaneously.[5] Thus they form three interwoven dimensions whose shifting interrelationships need to be tracked over time. This means that understanding what a particular technology does, for example in the case of the *Journal*, involves diving into the messy world of actual people, of 18th-century natural historians, their relations, their friends and interlocutors, their mental dispositions, their cognitive structures, the main load-bearing arches and beams which support the rest of their mental architecture, as well as their cognitive tools, their instruments and devices, and the intimate details of their construction, how they're built, their nuts and bolts, which have implications for how they process information and reify the tiny bandwidth of reality which they aim to mediate. The integrative perspective which the concept of cultural techniques affords aims to tackle this problem by tracing the chains of operations as their trajectories unfold across all of these elements.

The second notion I want to highlight is the world-building potency of cultural techniques. Reality is of course not only that which we look out at, but a synthesis of that which looks and that which is looked at. The privilege of a historian is to know that this synthesis is subject to change. There is, in other words, a genealogy of the real. And so in tracing this genealogy, one would have to answer the question, as one places oneself within a given historical epoch; "how is this synthesis expressed in this specific time and place?" The answer to such a question would undoubtedly be complex and draw upon several knowledge traditions, some of which would be anchored in collective, social, and public perspectives, others in individual, phenomenological, and personal perspectives. But inevitably the answer

[5] There are a multitude of different ways that one could begin to understand such a stance. One possibility is to see it as a metaphysical statement regarding the nature of reality. Developing this line of thought further would require firstly a clarification of the relationship between the three dimensions, i.e. are they simply aspects of a more fundamental process, or in fact separate but profoundly interconnected strands, and secondly the issue of the relationship between the three dimensions and reality at a deeper level. While such reflections are undoubtedly important and useful, the attitude I adopt here is a more pragmatic one. Thus one could see the idea of the three dimensions simply as an indexing tool, a list if you will, of elements that an integrative theory of knowledge would have to talk about in order to avoid undercutting itself by accumulating blindspots.

would involve some kind of focus on cultural techniques, or on how the real is constituted by procedures, techniques and operations. The world, one could say, is perpetually building itself, both materially and representationally, and part of its world-building toolkit consists of cultural techniques. This is the significance I would place on statements such as Winthrop-Young's claim that "the study of cultural techniques takes aim at the materialities of ontologization"(Siegert 2018).

There is also another way to speak of the world-building potency of cultural techniques. They move, Siegert says, "ontology into the domain of ontic operations"(Siegert 2015a). Ontic operations are actions which produce ontological concepts, just like drawing a line on the ground can produce the concept of territory (Wickberg & Gärdebo 2020).[6] Thus, says Winthrop-Young, "the study of cultural techniques aims at revealing the ontic operations that underlie and give rise to ontological distinctions which are then liable to take over thought"(Winthrop-Young 2013, 10). In this perspective, the act of measuring the temperature, or recording the seasonal movements of birds in a calendar, are ontic operations which serve to produce ontological distinctions. My emphasis in the analysis which follows in part 2 will be on the tools and instruments which enable these operations, or on what Friedrich Kittler has called the *technological a priori* of cultural distinctions and epistemes, which seeks to engage with, as Siegert says, "the medial conditions of whatever lays claim to reality"(Geoghegan 2013; Siegert 2015a).

2. Part 1: Gilbert White's *Natural History of Selborne*

Introduction to Part 1

What I would like to do in this section is to unpack the social dimension of White's knowledge project within which White operated as he unfolded his project. The advantage of thoroughly mapping the social dimension of White's knowledge about nature is that it allows us to better understand why he made the choices he made. And so we can ask questions like: What did he mean by observation? How did he view the importance of natural history; its utility, goal and purpose? Why did he oppose the taxonomic approach of Carl von Linnaeus? What did he deem as authoritative sources in his attempt to make sense of the natural world?

[6] Another example mentioned by Dünne et. al. comes from the story of Robinson Crusoe. One of the first things Crusoe does is to make a table and chair to use for eating. The use of a table and chair transforms the act of eating into a cultural act. These techniques are accompanied by other techniques, such as learned bodily dispositions of sitting upright and so on (Dünne et. al. 2020).

And how did Gilbert White, a parson by profession, see the project of natural history in relation to the doctrine of natural theology?

Natural History in 18th-century England

The world of natural history in the 18th-century comprised a varied and sprawling field with which there exists no proper analogue in contemporary society. The rigid and defined fences which police the boundaries between the current scientific disciplines had not yet been erected then. Thus a natural history could take as its subject the weather, the landscape, the zoology, or cultural history of a smaller district, like a county, or an entire nation. John Chamberlayne wrote the natural history of coffee, tobacco, tea and chocolate (Chamberlayne 1682). Comte de Buffon wrote the natural history of birds (Buffon 1793). Edvard Donovan wrote the natural history of Chinese insects (Donovan 1798). This point is important to emphasize, because it stresses the fact that actors such as Gilbert White were speaking and acting within a field whose structuring principles were not only very different compared to what was to come later, but also, as it necessarily appears from the vantage point of posterity, in a process of being solidified. In part, this relates to the fact that the field of natural history in 18th-century England lacked organizing features such as dedicated journals, institutions or scientific societies, which might have otherwise imbued it with a greater degree of professionality.

White himself also perceived natural history as a field undergoing a process of coming into its own. He possessed a strong perception of the embryonic character of the discipline. In a letter to his brother John White stationed in Gibraltar, commenting on an erroneous claim made by the 17th-century ornithologist Francis Willughby regarding the summer passage of the fern-owl, he remarks “you must remember that those excellent men, Willughby & Ray, wrote when the ornithology of England, & indeed the Natural History was quite in its infancy”(NHS vol 2, 273). But in whatever way White and other actors may have construed the field of natural history in the 18th-century, they in all likelihood viewed the different fields of knowledge as more or less permeable configurations, and this is, I argue, what allowed them to navigate disparate subjects with apparent ease.

Permeable boundaries and disciplinary nascency aside, there were nonetheless organizing ideals and norms which imbued natural history with a certain tone, flavor, and style. Pomata and Siraisi make the claim that early modern natural history was a strongly idiographic enterprise, concerned with particulars and details, and not much interested in general rules and laws (Pomata & Siraisi 2005, 5). This is certainly true to a certain extent in

White's writings. He once commented on his brother's manuscript for the natural history of Gibraltar that "your history is what I call true natural history, because it abounds with anecdote and circumstance"(NHS vol. 2, 63).[7] And indeed, *Selborne* is filled with circumstance and particulars. For example, White's lodges his descriptions of owls within narratives from personal experience ("I have known...") or conversations with others ("I was told by a gentleman..."). In part, this has to do with the fact that natural history in the 18th-century was often an epistolary enterprise. Taking place in a Republic of Letters, the practice of natural history in many instances became articulated by way of lettered conversations. This of course greatly defined its rhetorical form. After all, a letter lies some place in the middle on the continuum between the oral and the written. In addressing an absent interlocutor, a letter uses writing to serve some of the purposes ordinarily filled by speech. The convivial and amiable tone which characterizes *Selborne* may partially be accounted for by this circumstance.[8]

Central to this epistolary exchange were codes of conduct concerning how to address one's correspondent. One treated one's correspondent with reverence ("I need not remind a gentleman of your extensive reading…"), politeness ("I hope you will pardon the didactic manner for the sake of the information it may happen to contain…"), and humility ("my vanity cannot suggest to me that I shall send any information worthy your attention…"). These kinds of affective gestures are what defined the ethos of the Republic of Letters and supplied it with its particular emotional register.

It is also likely that White's stylistic choices arose out of his keen awareness of the status of nature writing within a larger bustling commercial industry of publishing. As David Elliston Allen has pointed out, 18th-century England was witness to the meteoric rise of natural knowledge to fame and popularity, something he attributes to the writings of Linneaus

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[7] It is worth noting White's choice of words in his statement; "Your history is what I call true natural history." In other words, it indicates that there may have been other prevailing opinions about the position of circumstance and anecdote in natural history. Other naturalists, such as Buffon, certainly did not use these kinds of elements as often as White, but they are still present (Buffon 1793 vol. 3, 266). Neither did Linnaeus refrain entirely from circumstance in his writings, as can be seen in *The Elements of Botany* (Linnaeus 1802). Not even his magnum opus *A General System of Nature*, otherwise a paramore of clean and stark style, was completely divested of anecdote (Linnaeus 1806, 915).

[8] In the advertisement for the first edition of *Selborne*, White gives an account of what he hopes the work shall achieve. As expected, there are the usual tropes of advancing knowledge and revealing the wonders of Creation. But if all that fails, he says, if the work does not achieve any of its aims, it has still all been worth it. Why? Because the work has "led him to the knowledge of a circle of intelligent communications[...]" that have "afforded him much much pleasing information[...]"(NHS 1789, iv). And there you have it: the essence of scientific practice—friendship. This is more than just a quaint nicety. Knowledge-production is inherently dialogic, as the epistolary activities of White show us. But more importantly, high-quality dialogicity requires mutual trust, understanding and consideration. Being a good person doesn't make you a good scientist, but it sure makes a big difference.

(Allen 1976). With the book-market providing an increasing number of botanical handbooks, it became fashionable to go on field-trips to study and collect plants and flowers. The acquisition of natural objects in the form of collectibles gained, as Allen claims, a popularity it has never enjoyed since. There was a demand for paintings depicting natural scenery, and the latest development in natural history became the topic of conversation in the salons of London. In a letter to his brother, discussing the economic risks of John's prospective publishing venture, he remarks: "Anything in the natural way now sells well"(NHS vol. 2, 41). In his brotherly guidance to John concerning his book on the natural history of Gibraltar, White stresses the importance of incorporating many engravings of decent quality. He advises his brother to write shorter, less convoluted sentences, and to use a greater variety of verbs. Some of White's marketing savvy undoubtedly came from his close relations to his brother Benjamin White, who owned a printing shop on Fleet Street, ground central for London's bustling printing industry, which specialized in works concerning natural history and attracted many avid naturalists (Foster 1988, 80).

White's opinion on the rightful place of anecdote and circumstance in natural history writing can not be accounted for by the fact that natural history was, as Pomata and Sirasi claim, a strictly idiographic enterprise, a remnant from an Aristotelian hierarchy between inferior descriptions of particulars subordinated to the superior explication of final causes. It was also a conscious choice responding to the commercialization of nature writing in the 18th-century. There were, to put it straightforwardly, a lot of people writing books and a lot of people buying them. London at the turn of the 19th-century counted 750,000 inhabitants (Great Britain Census Office, 1871). One must assume that White, as he was contemplating the publication of his book, contended with the reality of having to make his voice heard within the loud, cacophonous clamor of the London publishing industry, as well as having to engage with a potentially large audience coming from many different backgrounds.[9] And besides, the genre of natural history in the 18th-century, as we shall soon see, incorporated both descriptions of particulars as well as explications of general rules. White was, in fact, greatly occupied with uncovering general laws and principles. The true botanist, according to him, "should investigate the laws of vegetation"(NHS 215).

[9] An interesting note in this regard is that White included much of his correspondence with Pennant and Barrington in the final version of *Selborne* unedited (Dadswell 2019, Location No. 432). It is possible that White pondered the notion of publishing the letters from an early stage. If so, his choice of style, which many authors refer to when accounting for the massive commercial success his work enjoyed in the 19th-century, simultaneously grew out of the customs of the epistolary format, and his awareness that his letters might potentially one day receive a larger readership among the wider population.

The Outdoor Method

Gilbert White held a peculiar position in the field of natural history in the 18th-century. He both advocated and practiced a form of natural science which few of his contemporaries shared. While the majority of his colleagues were preoccupied with matters pertaining to anatomy and taxonomy, White was more concerned with what we today call ethology. Animals, he contended, should be studied where they live, in their natural state. He was interested in the relation between behavior and environment. It is very likely that the gaze with which he beheld the natural world was honed and shaped by his experience of being a sportsman in his younger years (NHS 140).[10] Hunters have of course always been keen ethologists. Theirs is a tacit knowledge; a cultivated art of noticing, which involves seeing, hearing and sensing. He must surely also have acquired a penchant for investigating and accounting for nature *in situ* through his work as a gardener. After inheriting the Selborne estate, White came to provide over roughly two hectares of productive land. The scientific and experimental attitude he adopted in his approach to growing food is evident in his diligent journaling in the *Garden Kalendar*.

White did not refrain from voicing his methodological leanings. Several passages of *Selborne* convey polemical charges against his contemporary colleagues. "Faunists," he says, "[...] are too apt to acquiesce in bare descriptions, and a few synonyms: the reason is plain; because all that may be done at home in a man's study[...]"(NHS 140). The faunists referred to in this quote are botanists who published works whose general structure resembled lists, consisting of brief descriptions, written in a short, abrupt style.[11] A case in point here would be Richard Weston's *Botanicus Universalis* (Weston 1772), but also to a certain extent Linnaeus' *A General System of Nature.*[12] True natural history, then, according to White, can

[10] This is not to say that he was the only naturalist to study nature outdoors. Linnaeus had his famous journey to Lapland, and White's interlocutor Thomas Pennant embarked on an expedition to Scotland. Their general approach, however, tended not to situate their objects of study within a local habitat. Thus my argument is that while many naturalists traveled outdoors to study nature, there were only a minority who conducted ethologically oriented studies. For more on outdoors naturalism in a Norwegian context, see Brenna 2011, Eriksen 2007.

[11] The term "faunist" was not a phrase that was used often in 18th-century natural history, and it hardly shows up in any other writings.

[12] When White is expressing himself in this way, appearing to position himself in opposition to what was the leading figure of natural history at the time, it might be taken as a sign of disapproval. But there is reason to believe that the matter is more subtle. White is of course in constant dialogue with Linnaeus throughout *Selborne*, comparing his terminology with that of Ray, and pointing out errors and inconsistencies, not to mention his refutation of Linnaeus, who, echoing Olaus Magnus, proposed that swallows hibernate in river beds during winter. He describes Linnaues writing-style as "clean, just, and expressive"(NHS 87). If he wanted to publicly deride Linnaeus, he would be likely to find many supporters. Toward the end of the 18th-century, there was in fact a lot of anti-Linnaean sentiment brewing in English natural history. "It is fashion now", says White in a letter to his brother, "to despise Linnaeus." But there is reason to believe White respected Linnaeus, but saw that he represented an earlier stage of natural history. As he passes by his brother's printing shop on Fleet Street

not be achieved “at home in a man’s study”, but must be conducted in the field, as he himself so often did, either on horseback, or on foot. The real object of study for a naturalist must be “the life and conversation of animals.” This phrase is repeated several times throughout *Selborne*, and it neatly captures the essence of his approach to studying nature. Studying the life and conversation of animals, and also, as he later elaborates, “their actions and oeconomy”, constitutes the “life and soul of natural history”(NHS 81). In other words, it is not enough to study books and systematics. Since the animals can not come to the naturalist, the naturalist must come to the animals. And thus he stresses the importance for people who live in the country to make “daily observations.” This, he says, “is a concern of much more trouble and difficulty and is not to be attained but by the active and inquisitive, and by those that reside much in the country”(NHS 81).

In a later passage he further elaborates upon the case against botany as practiced by the faunists. “The standing objection to botany has always been,” he says, “that it is a pursuit that amuses the fancy and exercises the memory, without improving the mind or advancing any real knowledge: and where the science is carried no farther than a mere systematic classification, the charge is but too true”(NHS 215). And so we can ask; if mere systematic classification is not real knowledge, then what is? In the latter part of the paragraph White unfolds his programmatic decree for what natural history should be. In order for a botanist to cast off the charge of being a mere manufacturer of lists, “he should study plants philosophically, should investigate the laws of vegetation, should examine the powers and virtues of efficacious herbs, should promote their cultivation; and graft the gardener, the planter, and the husbandman, on the phytologist"(NHS 215). It is not that more theoretically oriented studies are to be cast aside, or that mapping the system of nature is an inferior endeavour, because “without system the field of Nature would be a pathless wilderness”, but rather that system represents the starting point, not an end in itself (NHS 215).[13]

To study plants philosophically is a worthwhile pursuit because plants sustain humans, and are therefore of utmost importance. This observation must be seen in the context

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one day, he happens to pick up a letter there from Linnaeus, at the time 65 years old, to his other brother, John White. After reading it, he comments later in a letter to Pennant; “the old arch-naturalist writes with spirit still”(NHS vol. 2, 72).

[13] The turn toward the concept of system is highly interesting in itself, and Clifford Siskin has shown the great importance of this concept in the shaping of modern knowledge (Siskin 2017). The utility of this concept lies in its ability to be either whole or part, depending on one's viewpoint. Nature is a system, but there is also the system of plants. So the system of plants is both a whole containing other parts, and itself a part within the system of nature. Thus the structural features of the concept of system is such that it allows the performance of cognitive operations wherein multiple scales can be traversed while retaining structural similarity across scales. In other words, you have systems within systems within systems, but whether you are looking at system at level 1 or system at level 3, the constituent features of system remain constant.

of the agricultural improvements of the late 18th-century. Here White's own words describe the situation best. "Every middle-aged person of observation," he says, "may perceive, within his own memory, both in town and country, how vastly the consumption of vegetables is increased."[14] Thus, his programmatic decree to study plants philosophically was part of a larger project of advancing agriculture as a whole in order to give people better food.

Another even larger, still more important context loomed in the background of White's idea of natural history. Writing in an age of prolific trans-oceanic trade involving sugar, tea, tobacco and coffee, he observes that the "productions of vegetations have had a vast influence on the commerce of nations." And so, in his final conclusion, he turns to grass. Grasses are what sustain livestock and form the indispensable foundation for animal husbandry. The study of grasses, he says, "would be of great consequence to a [...] grazing kingdom" (NHS 216). Ultimately, botany is to be a servant of the commonwealth such that it can strengthen its position vis-a-vis other nations. These are the thoughts White had about the role of natural history. It answers the question of what he himself thought he was up to. But what were his thoughts about the nature he was studying? What was the meaning of nature for Gilbert White?

Local Nature

White wanted to study animals and plants in their natural habitats, to see their behavior, their life and conversation. And he did so in his own parish, in Selborne and its surroundings, where he lived for most of his life. White resided in Selborne for the whole 25-year period he made his daily recordings in *Naturalist's Journal* and carried out his epistolary exchanges with Barrington and Pennant. White's aptitude for living nature can certainly be seen in connection to this. That which is close at hand is also more likely to be alive. Books about foreign faunas on other continents, or taxidermied birds from Gibraltar do not evoke a living nature. Necessarily the life and conversation of animals becomes displaced through techniques of bringing near that which is distant. So naturally local nature takes on a greater importance in his methodological disposition. He specifies this further in the advertisement for *Selborne*.[15] Here he advocates for what he calls a "parochial history". Elaborating further,

[14] This sense of manifest progress, of advances both felt and observable—perceivable in one's "own memory"—either in agriculture, commerce or science, is a sentiment found in many places throughout *Selborne*. We can see this in the context of Koselleck's *sattelzeit*-hypothesis, wherein a relationship between past, present and future based on repetition gives way to a temporal sensibility wherein time becomes a dynamic force and where the present drills its way into an open-ended future, leaving in its rearview-mirror an ever-receding past (Koselleck 2004).

[15] Most of the editions of *Selborne* seem to omit the advertisement. The main edition I am using in this thesis, which is edited by Bennett, does not include it. However, the first edition printed in 1789 does.

he accounts for what today would be thought of as a gap in the research literature. “If stationary men,” he says, “would pay some attention to the districts on which they reside, and would publish their thoughts respecting the objects that surround them, from such materials might be drawn the most complete county-histories, which are still wanting in several parts of this kingdom [...].”(NHS 1789, iii).[16] It is not strange that he feels the need to specify his intention to write a natural history with an emphasis on the local. Several centuries earlier it might have seemed superfluous. But in an age of vast oceanic trade, travel and exploration—in the first centuries of the world system—there is a greater sense of the vastness of the globe, which in turn contextualizes the local, and sets it in its place (Wallerstein 1974).

The contemporary colleagues he quotes the most, namely, Scopoli, Buffon and Linnaeus, often spanned the globe in their faunas and floras. Theirs was an all-encompassing grasp. Certainly there was much information available about foreign and exotic natures at the time, as well as the expectation that there would yet be more to come. This must have been obvious to White himself. In the summer of 1768, he spent the evening at the house of Joseph Banks, the naturalist who would accompany James Cook on his first voyage around the world, just two months before they set sail from Plymouth (NHS xlv). So interconnected was the world system at this time that White was able to follow, with great interest, the news of Cook’s expedition from year to year as it was reported in London newspapers such as *Gentleman’s Magazine.*[17] However, despite this intrusion of the global upon the local, and notwithstanding White’s invocation for a parochial history, he performs a highly interesting move. He flips the script. It is not that the global is big and the local is small, but rather, that in the local there is an infinite multitude. “All nature is so full,” he says, “that that district produces the greatest variety which is the most examined”(NHS 59). The field of nature contains “endless room for observation”(NHS 126). Thus the turn to local nature is not a turn to a smaller scale, because nature, as he says in the same passage, is boundless. Looking upwards and far away, one sees vast diversity. But looking downwards and close at hand, one sees vast diversity also. The more one looks, the more one finds. Such is the endless and

[16] It is also worth noting that a parochial history according to White must include both “natural occurrences” and “antiquities”, which is why *Selborne* contains both a section on natural history, and a section on antiquities. Nature and culture, it seems, were not to be separated.

[17] Upon Banks' return in 1771, White is invited to his house in London for a visit. And as he steps inside, he is met with a most remarkable sight. Banks had built up a vast collection during his trip, and it was fully on display in his three-story house. White simply gawks as he gazes upon native tools and clothes from indigenous peoples from South America and New Zealand. As he makes his way to the second and third floor he is again at a loss for words as he is met with an immense variety of preserved animals, insects, birds, and fish from all over the world (NHS vol 2, 99).

boundless structure of the field of nature. And the sheer amount of things White writes about is a testimony to his view that the area which produces the greatest variety is that which is most examined. In *Selborne* he touches upon worms, weather, wheat, wasps, water rats, vipers, fossils, frosts, frogs, fogs, flowers, flies, fish, cats, cows, kale, crickets, spider-webs, squirrels, echoes, hogs, hens, hedgehogs, bats, birds, bees, dogs, pheasants, and the list could continue indefinitely.[18] Indeed, one could say that one of his ambitions was to disclose the boundless multitude of nature as it revealed itself in his local area of Selborne.

White's insistence on studying local nature, which is to be carried out—he repeats this notion several times—by those residing in the country, also ties in with a belief, peculiar to the 18th-century, in local natures as households. Daston shows in *Against Nature* that 18th-century naturalists such as Linnaeus used the term "oeconomy" to describe local floras and faunas (Daston 2019, 18). This is of course a term much favored by White himself. The root of the term comes from the Greek "oikos" which means household. When using the phrase "oeconomy of nature" White is referring to a bounded unit of interrelated parts, entangled to each other in relations of mutual dependency, of give and take, in an established division of labor. Just like the equilibrium of a household is guaranteed by a benevolent distribution of labor and resources among its members, so to the equilibrium of local nature, its harmony, balance and wholeness, is guaranteed by the sustained co-operation between its participants. In a highly telling phrase, where there appears the surprising addition of a capital N, he says "Nature [...] is a great economist"(NHS 23). It is in other words nature itself who is the great householder. This view is further exemplified in his discussion of the earth-worm. This small insect, he argues, plays a much more important role in the larger picture than people are aware of. They are really essential for soil health. They dig and tunnel the soil, creating the pores with which the earth drinks water and breathes air, and they nurture the earth through their manure. Indeed, they appear to be "a small and despicable link in the chain of Nature[...]". But if they were to disappear "it would make a lamentable chasm"(NHS 201).

Here we are of course confronted with the notion of the Great Chain of Being, so masterfully expounded upon by Lovejoy, which constituted the main architectural principle of the Christian worldview, the idea of a continuous ladder of being, stretching across the vast expanse of Creation, from the lowest rungs of minerals and matter, all the way up to God himself, without leaving so much as the most miniscule rift (Lovejoy 1964). No holes, no

[18] It is hard not to summarize the brevity of White's topics without relapsing into a performance of dadaist poetry.

vacuums, no gaps. Just pure continuum: from dirt to Divinity.[19] This notion that each being, no matter how small, fills an important role in the greater household of nature also relates to the philosophy of physico-theology, which greatly influenced White's views on nature.

Physico-Theology

Any discussion of 18th-century natural history would not be complete without a discussion about religion. The great majority of British naturalists had their careers within the church (Armstrong 2000). However, 18th-century naturalist thought comprised a number of different views about the relationship between God and nature. One central issue around which many discussions revolved was the notion of teleology. Ideas about inherent harmony, balance and built-in dispositions toward parsimony structured much of the thinking of early modern naturalists. The idea that everything in nature has been given an earmarked place in the whole with a corresponding role to play by the creator is at least as old as the Old Testament, as we can gather from Psalm 104, which reads "How many are your works, Lord! In wisdom you made them all; the earth is full of your creatures"(Psalm 104, NIV). This is the quote that inaugurates John Ray's *The wisdom of God manifested in the works of the Creation* (Ray 1691). Ray was the most renowned natural historian in England in the 17th-century, and no doubt one of White's great inspirations (he refers to him as "the excellent mister Ray"). He proposed what we might call a strong version of the natural design argument. Reasoning by analogy, he claimed that since human art has reason behind it, how great must the reason behind nature be, because nature is superior to art (Glacken 1967, 417). The proportion between land and sea is just perfect, he claims, because if there were less land, it would not be hydrated properly, and humans would not flourish.

In an argument which is more illustrative of his mode of reasoning, he claims that plants must be the result of a divine mind, because all of their parts work perfectly together to serve the whole. This is a great example of the kind of analogical reasoning which is the soul of many natural design arguments still to this day. Whenever parts are assembled to serve a whole, such as in a house, a horse-cart, or a clock, it is usually the outcome of intelligence. And so, since like effects typically have like causes, the functional arrangement of the parts

[19] One of the implicit implications of the Great Chain is that it also entailed a continuity of interiority across domains of being. An example of this is seen in John Ray's idea of the soul of vegetation, an idea that goes all the way back to Aristotle (Ray 1691, 74). Not only was vegetation ensouled, but animals as well. This complicates in an interesting way Viveiro de Castro's contrast of Amerindian multiculturalism (beings have common nature on the level of interiority, differing nature on the level of exteriority) with Western multinaturalism (beings have differing nature on the level of interiority, common nature on the level of exteriority)(Viveiros de Castro 1992).

of the plant must similarly be caused by an intelligence. Another kind of argument stresses the many instances of the functional fit between beings and their habitat. Different countries produce different species of plants which are uniquely suited to the humans and animals that reside there (Glacken 1967, 420). White echoes this kind of reasoning on several occasions. The wings of the fern-owl, for example, make no noise as it swoops down to grab its prey, and he speculates that the constituent features of its wings derive from this circumstance (NHS 149).[20] He also observes that different species of swallows employ different styles of flying, and he wonders if this might be because they tend to catch different kinds of insects.

However, White was also an empiricist. Someone who records written observations on a daily basis does not do so without a strong commitment to empirical observation, and this significantly contributed to constricting his use of analogous reasoning. In one of his letters to Barrington, he apologizes for his previous assertion of the southward migration of the ring-ouzel derived from the southward migration of other birds. He admits that he "reasoned in that case from analogy", and that this does not preclude the possibility of their westward migration (NHS 72). Analogous reasoning alone will not suffice; only further empirical investigation could settle the matter. It is really White's empiricist disposition which allows him to move beyond the kind of design arguments earlier employed by John Ray. While Ray tended to see the functional fit between beings and their habitat as more or less static arrangements, White was able to uncover many circumstances which contradicted the functional fit hypothesis of natural design. He observes, for example, that there were born many more birds in his neighborhood than could possibly be sustained into adulthood, that an excess of individuals lead to rivalry and jealousy, and that the profusion of harvest bugs deteriorated crops in his parish (Dadswell 2019, Location No. 855).

Here I want to argue that it was his observational habits that played an essential part in his process of conceiving a dynamic nature based on a shifting interplay between species and habitats. One example of this is found in his speculations on the cuckoo. This bird represents an exception to what he calls the first great dictate of nature, which is maternal affection, because it abandons its eggs in the nests of other birds.[21] However, this deviation, which constitutes "such a violence on instinct", is abated by the fact the cuckoo is imbued with "a more enlarged faculty of discerning", which allows it to discern which other birds display more maternal affection (NHS 123). It is, in other words, not that the intelligent

[20] He begins this speculation with a notable "perhaps" which already indicates a different attitude than that of Ray.
[21] White consistently uses the phrase "storgi", spelled using the Greek alphabet; στοργή.

behavior observed in nature is imposed from outside, neither is it a static pattern mechanically adhered to, but rather that it is a resource employed by the beings of nature themselves. White's nature is not the clockwork nature of deism, wound up by the great clockmaker at the dawn of time to tick away accordingly forever henceforth, but rather a dynamic, living nature, where beings are endowed with discernment and may exercise agency within the whole. Thus, he concludes, "the methods of Providence are not subjected to any mode or rule, but astonish us in new lights, and in various and changeable appearances." There is not a given set of rules underlying the appearances of nature once and for all. Nature, in other words, is change.

And the way that nature changes can be subjected to empirical observation. Thus he observes that the same animal can behave differently in different circumstances, for example when he observed the early migration of swallows several months before their usual retreat during a particularly warm August month. This of course bears upon the crucial issue of migration and of the punctuality of the arrival and departure of birds in the spring and autumn. It must have been tempting for White, a parson after all, to concede this circumstance to providential design. But he refrains. He does not settle for the design argument. Here I want to argue that White oscillates between two positions. The first position is the empirical position and concedes that whatever underlies the punctuality of avian rhythmicity is somehow manifest in the phenomenal world and thus subject to observation. The fact that White maintained his habit of recording bird arrivals in his journal until his very last years testifies to his commitment to this position. The other position comes to the fore not in White's naturalist writings, but in his poetry. Here he enters into a different register characterized by a dense affective tonality. There are specifically two poems which are relevant to mention here. In *A Naturalist's Summer Evening Walk* we can read:

> "Amusive birds! say where your hid retreat
> When the frost rages and the tempests beat;
> Whence your return, by such nice instinct led,
> When spring, soft season, lifts her bloomy head?
> Such baffled searches mock man's prying pride,
> The GOD of NATURE is your secret guide!"
>
> - NHS, p. 71

And in another poem, unnamed by White himself, we read the following lines:

> Say, what impels amidst surrounding snow
> Congeal'd the Crocus' flamy bud to grow ;
> Say, what retards amidst the summer's blaze
> Th' autumnal bulb; till pale declining days?
> The God of Seasons! whose pervading power
> Controls the sun, or sheds the fleecy shower;
> He bids each flower his quick'ning word obey,
> Or to each lingering bloom enjoins delay.
>
> - NHS, p. 504

Especially salient here are the terms “God of Nature” and “God of Seasons”. These are not the God of Deism which was fashionable among many natural theologists at the time. The God of Deism created the world and then stood back to watch it unfold, choosing only to intercede in rare moments of divine intervention. Rather, this is the God of Pantheism, a God whose very threads were seen as interwoven into the fabric of manifest existence. Ted Dadswell lends further credibility to the argument in his claim that by using the terms God of Nature, White was expressing a form of virtual pantheism, which he claims was in vogue in Britain during White’s later years (Dadswell 2019, Location No. 4096). This sense of a manifest, visible divinity also becomes noticeable in the manuscript for *Selborne.* In the published version he writes about the different blooming times of the crocus that it “is one of the wonders of the creation, little noticed, because it is a common occurrence: yet ought not to be overlooked on account of it's being familiar, since it would be as difficult to be explained as the most stupendous phaenomenon in nature.” However, in the handwritten manuscript we find not the term “stupendous”, but in its place the term “sublime.” While “stupendous” connotes astonishment and marvel, the concept of the “sublime”, that oft-favored motif of the Romantics, connotes almost something sacred; a subtle radiant glory and diaphanous numinosity. However, I want to clarify and deepen Dadswell’s argument by adding that what characterized the theology of the late 18th-century, and that which simultaneously paved the way for British romanticists like Coleridge, Wordsworth, and Byron, was the collapse of the Great Chain of Being under the scrutinizing gaze of empirical science.

The Great Chain, being essentially an emanationist doctrine with platonic roots, had guaranteed the interior continuity of Creation during the Medieval Age and the Renaissance. All beings partook in the greater being of God through a logic of downward emanation. Thus the Great Chain was the glue which held it all together, both interior and exterior nature, from the lowest rungs of the material world to the highest reaches of the divine. But as baseline procedures of veridiction shifted during the Renaissance, which now started to concern themselves only with exterior reality, interior reality, seeing as it could not be verified with the same methods, was left by the wayside, and the previously seamless scale of being, which had tied together both interior and exterior reality, started to come undone. God, nature and self, no longer united in the Great Chain, started to sail their own separate ways. No longer were humans nestled snugly within the vast sweep of a divine creation, which both imbued and shared their interiority, but found themselves on the outside looking in, as alienated Cartesian subjects suspended in a strange vacuum gazing outwards at a vast surface of objects.[22] And so the Great Chain of Being became, as Charles Taylor has put it, "the universe as a vast interlocking order of beings"(Taylor 1989, 244).[23]

Early modern thought thus found itself in a peculiar situation. Now that the interiority of nature was no longer accounted for by the Great Chain, and it was starting to look more and more like only God and human-beings possessed interiority, the question then became; what kind of being does nature have? Various approaches contended with this dilemma in various ways. Mechanistic natural philosophy was one available route, which of course withheld interiority from nature completely, and was taken by figures like Laplace and Descarte. Vitalism was another, which made use of concepts like life force, impulse or instinct, and was taken by figures like Buffon and Ray. Another approach is found in the *naturphilosophie* of figures like Goethe and Schelling. The latter complained about European philosophy after Descarte that it had the common defect "that nature does not exist for it and

[22] Pascal was not only a brilliant mathematician, but also deeply sensitive to and aware of the changes underway during his time. Thus he was able to grasp their deeper significance, their ontological net cost one could say. He looked out at the new universe, no longer ensouled, no longer animated from within by the breath of the divine, and realized the existential unease it entailed. Thus he said: "The eternal silence of these infinite spaces fills me with dread."

[23] This process was played out in miniature fashion in the scientific career of Johannes Kepler. Early in his career he had accepted the idea, quite ordinary at the time and traceable to a Stoic origin, that planets find their way through space because they possess an intelligence or spirit. As long as their orbits were circular, this made sense to Kepler, and he could understand how a planetary intelligence could do the necessary calculations from moment to moment to maintain a cyclical movement around a fixed point. But when he considers the mathematical complexity of epicyclic motion, he cannot fathom how such a planetary spirit could make its body perform such complicated movements. Thus, one of his key moves later on was to replace *anima* (soul) with *vis* (force), and, as he himself said, he longer wished to regard nature as *instar divini animalis* (divinely animated being), but as *instar horologii* (as clockwork) (Dijksterhuis 1961).

that it lacks a living ground"(Schelling 1987, 236). Thus they started to work with the concept of the World Soul, and Schelling eventually came to decree that "Nature must be visible spirit"(Davies 2018).[24]

Another important route, not entirely unrelated to *naturphilosophie*, was pantheism, which sought to bestow nature with a living ground through seeing nature not as a shadow realm concealing a deeper, more fundamental transcendental reality, as it had been conceived in Medieval Christianity, but as a new kind of divinity in its own right—a new god—a living, manifest god. It is possible to see White, as he in a moment of poetic inspiration pens the phrase "the God of Nature", which is clearly distinct from the God he speaks of in his sermons, in this context. This relationship between a commitment to exact empirical observation and a recognition of the divine ground of nature—between measurement and mystery, science and the sacred, reason and religion—was a central issue of the time. The literary scholar Amy M. King has coined the term "reverent empiricism" for White's practice, because it represented a way of expressing reverence for God through unearthing the plenitude of Creation (King 2019). It was arguably just as much scientific observation as religious observance.

The rhythms of nature, their regularity and precision, were not seen as signs pointing to divine reality located elsewhere, as surfaces which could peeled away to reveal a truer, deeper, more real, divinity hidden behind the curtain. Rather, they were seen as the sublime itself. They were the God of Seasons manifest—visible, sensible, palpable—the sacred as incarnate. And this pantheism pointed the way towards a specific mode of conducting natural science. The attempts to uncover the laws of nature are, according to White, inadequate. It is a search that mocks "man's prying pride". But luckily this is not the end of the story. Man has an ally in the search, a hidden teacher and confederate. "The GOD of NATURE is your secret guide!" From this I believe that the scientific program that White followed, which was simultaneously empirical and theological, can be made explicit: pay close attention to the visible world, and the God of Nature will guide you on the path toward understanding. It was no longer, as it is stated in Colossians, "set your minds on things above, not on earthly things," but rather, fix your gaze on earthly things, and pay no mind to things above. This is, I believe, the true meaning of reverent empiricism.

There is a connection here also to the use of the *Naturalist's Journal,* which White so diligently kept filling up with details about weather, plants, animals, insects, and gardening

[24] Incidentally this involved going back to the roots of the idea of the Great Chain; to antiquity and to Plato and the *Timaeus,* which is perhaps the first philosophical work fleshing out the idea of a world soul (Davis 2018).

and agricultural activities. It fit the program of reverent empiricism perfectly. For a religious practice that no longer sought the divine in an inward vertical ascent—which had been more or less the standard program in the worldview based on the Great Chain—but rather in the visible, manifest world; a knowledge tool that could register only empirical-sensory entities—only surface and no depth—fit the bill impeccably. The question was no longer "what does it mean?" but "what does it do?" And the *Journal* was perfect for that question. In fact, it was the only question it could answer. Thus the *Journal* was both a result and a cause in the development of reverent empiricism. It was its technological a priori which provided a repertoire of cultural techniques uniquely suited to its task. Now that reverence was to be expressed through a thorough mapping of the boundless field of nature, the *Journal* formed an indispensable tool which expanded the capacity to take in its complexity, without which human-beings's cognitive capacity would be wholly inadequate. It was as much a tool to produce knowledge as a tool to reveal the God of Nature. "All nature is so full," says White, "that that district produces the greatest variety which is the most examined"(NHS 59). In other words, variety is a function of examination. And therein lied the postulate of White's reverent empiricism: to continually reveal the fullness of the divine through a steadfast observation of the minute particulars of the natural world.

3. Observation

It is time now to turn to the fields, forests, and faunas where White would often spend hours watching, listening and observing. In the following I am more interested in looking at the actual practice of observation White carried out; what it entailed and how it fit together with other activities, and more importantly; how it relates to time. In her essay *Observation as a Way of Life,* Lorrain Daston makes the claim that "observation creates time"(Daston 2011). It is true, as she shows, in two distinct senses. The first sense emerges by looking at ancient practices of astronomy, hunting and sailing. Whether watching the stars, lying in wait for the game to appear out of hiding, or waiting for a sign signaling the turning of the wind, practitioners of these ancient arts bear witness to the principle that certain forms of time are intimately entangled with techniques of attention. It is the right kind of attention that reveals what kind of action the moment requires. Careless, flimsy attention will not discover the proper sign; what the stars say, when to shoot, or when to change course. Sustained, vigilant attention only may distinguish signal from noise. In this way observation shapes time. White's experience as a sportsman as a young man is important to mention here. Through his

hunting practice, he learned to cultivate that keen eye, that sustained attention, which hunters must employ.

The second sense is more literal. For most of human history, telling time and observation have in practice been the same thing. Astronomers since Egyptian and Babylonian civilization had read the skies to know when to commence festivals and rites and to prophesize events to come. Here the close correlation between "observation" and "observance" becomes especially salient, as one of the key features of early modern astronomy in relation to religious time was to indicate which kind of ritual act was to be observed. When to pray, when to purge, and when to bathe were all specified in farmers' almanacs and calendars which triangulated one's position in the unfolding drama of Creation as it stretched from the dawn of time to the last judgement (Chapman 2007). Knowing the time was to know one's location within this expanse of meaning. In the farmers almanac every when is also simultaneously a why, as every time point is accompanied by the name of a saint, an astrological configuration and corresponding body parts.

Farmers also carried out observation as they carefully monitored the signs of spring in order to know when to start the preparations for sowing. As winter waned, they would attend each day to the melting snow on the fields, and to the slow dance between water and frost that plays out in the interstices of spring and winter. These events were accompanied by other occasions, such as the sounds of the woodpecker, the browning fur of the hare, and the early stirrings of bees and insects. When the time was deemed right, certain activities would ensue; winter tools were stored away, manure was prepared, and garden plots were fenced.[25] Of course, hunters too had to tether their watchful gazes to the treelines, watching for first signs of the return of birds after winter. It is important to note here White's practice not only as a hunter, but also as a husbandman. His gardening practice most probably attuned him to the nuances of the shifting seasons, and to small changes in temperature and their effects on vegetables and produce.

He accounts, for example, of a peculiar situation in the winter of 1774, where there was a significant snowfall lasting three days. After that followed days with bright sunshine and hotter temperatures during the day and freezing temperatures at night. This freezing and thawing damaged his plants, while the same plants grown by a neighbor located at higher altitude with consistently cold temperatures were unfazed (NHS 261). He therefore encourages planters to use mats and cloths to cover plants, or to remove snow, in such

[25] The Danish-Norwegian priest Jacob Nicolai Wilse published a calendar in 1779 detailing on the one hand the natural events of each month, and on the other the appropriate agricultural activities (Wilse 1920).

conditions. He then proceeds to show the paradoxical circumstance that tender trees, when planted in hotter areas, have premature bud-bursts in spring and delayed growth into autumn, which predisposes them to frosts. What he is referring to here, a phenomena which has only recently been documented by modern phenology, is that the bud-burst of trees is strongly correlated to optimal chilling conditions during winter (Vitasse & Basler 2013.[26] In this way, White partook in ancient practices of telling time by observation. But observation in the early modern period also underwent significant changes.

On this matter, Daston remarks that "in the course of the sixteenth and seventeenth centuries, observation was transformed from an activity chiefly pursued by illiterate peasants and sailors into a prestigious form of learned experience, practiced by physicians and naturalists intent on reforming medicine and natural philosophy"(Daston 2011, 9). What White was engaged with, then, was what Daston calls "learned experience". Pomata and Siraisi, writing six years earlier, formulate a very similar phrase. They contend that what characterized the scholarly practice of early modern *historia* was "striking parallels between ways of observing and ways of reading", as well as "close links between firsthand observation and book learning"(Pomata and Siraisi 2005, 7). They call this new kind of practice "learned empiricism". There are thus two distinct gazes which compose the outlook of the 18th-century naturalist and which both come together in Gilbert White; the gaze of the huntsman and the gaze of the scholar. Both are skills which require practice and cultivation. And both are cultural techniques which articulate ontological boundaries within the lifeworld, as I will speak about in detail later on.

As the following examples will show, observational competence was composed of three elementary skills. These were waiting, seeing and listening. White would spend long periods in the field. Many times he would observe the same animal for several hours in a row (173 NHS). We might imagine that much of the time spent in the field was uneventful, quiet, even tedious. Thus waiting requires discipline, diligence and patience. Another skill is seeing. Many details that White observed would have been very difficult to notice, such as the fact that house-martins feed their young on the wing (NHS 173). He was also most likely the first to establish that swifts in fact copulate while flying. It was probably only because he had amassed hours and hours of practice that his eyesight was accurate enough to establish these facts. The last skill is listening. As any ornithologist knows, bird-watching is an auditory

[26] This of course has great consequences in the context of global warming, as the article cited above shows. If trees are subjected prematurely to hot temperatures, the whole subsequent growth sequence becomes out of whack.

affair. Singling out different bird calls from a more or less saturated auditory field can be challenging. It is worth noting in this regard that Gilbert White correctly identified that there were really three species of willow warbler, and not just two (NHS 29). This only became an established fact in ornithology centuries later, but White was able to identify the third sub-species by its call alone.The differences between their calls are very minor and would probably go unnoticed by most people.

But as I've said, it was not these skills alone which characterized early modern observation. As White looked out upon his natural surroundings he saw not only animals, plants, trees and insects, but also the whole edifice of natural history as he had managed to assimilate it through his privileged access to the great wealth of 18th-century nature writings facilitated by his brother on Fleet Street. This way of weaving together empirical observation with authoritative textual sources amounted to a deeply textured kind of sense-making. Truth was to be found in a recursive comparison between text and world. "Modern natural history," says Brian Ogilvie, "was born out of the attempt to understand ancient books on plants and animals, and to compare their claims with what naturalists observed themselves"(Ogilvie 2018, 20). Examples of this in *Selborne* are legion. In the question of the third sub-species of willow warbler, as mentioned above, he says in a letter to Thomas Pennant that "I perceive there are more than one species of the motacilla trochilus"(NHS 29). But then, more importantly, he proceeds to back it up with a speculation by William Derham who has proposed the same in his correspondence with John Ray. In other words, neither perception or textual sources are sufficiently authoritative on their own, only combined do they make a compelling case.

A more telling example in the following can serve to show the typical character of the early modern mode of veridiction. In the summer of 1769, White received a taxidermied bird from Thomas Pennant, which he claimed to be the *fen salicaria* (NHS 73). For Pennant, this was a more or less unknown species of bird, and he had not included it in his first edition of *British Zoology.* White then proceeds to make sense of the specimen. He observes it in the wild. He examines it while dead. He compares it to Pennant's specimen. He then consults the texts. There he finds that John Ray had put it in the wrong class, which is what most likely had led to Pennant's confusion. It had been placed in the class of *picis affines,* while it should have been put in the class of *aviculæ cauda unicolore*. He then consults Linnaeus. He seems to not have identified an identical specimen, but the closest one seems to be *motacilla salicaria.* It corresponds, says White, to what country people call the sedge-bird. In the end,

the matter is settled, Pennant is convinced and in later editions of *British Zoology* White's taxonomic consultations are heeded.[27]

What becomes clear in the example above is the active integration of many kinds of knowledges; knowledge of living birds, dead birds, natural history books, and even common parlor. Observation is cross-referenced with authorial sources like John Ray and Carl von Linnaeus. Spending time in nature observing living specimens was only part of White's method; the other included intense study. Truth for White required reconciling new observations with what had been written before. The presence of the lineage of past and present natural historians is invoked through White's use of the phrase "the writers". He observes, for instance, that the stone curlew abounds, and yet "the writers" mention it as a rare bird (NHS 46). He suspects that the ring ouzel is a bird of passage, but "the writers" are silent on the subject (NHS 60). The range of authors quoted is vast. He shows a keen awareness of the most important contemporary natural historians of Europe. But he also quotes older authors like the 16th-century natural historian Belon. He also sometimes consulted ancient classical poets like Virgil and Oppian for information about the natural world, and of course there is reference to Aristotle and Pliny. On more than one occasion there is reference to biblical passages. However, not all authors are equal, and tradition does not equal authority. Classical authors are included with cautionary remarks, because they did "not attend to specific differences like modern naturalists"(NHS 165). Even authors like Willughby, Ray and Derham, the best and brightest British naturalists of the 17th-century, were seen to have been working when the field of natural history was still in its infancy (NHS vol. 2, 273).

There is, however, a third kind of knowledge which must be added to the picture. White also filtered his knowledge about nature through everything he had learned through his abundant access to second-hand observations that he gathered on his travels to various

[27] This tale might also be a reminder of the power of taxonomic systems. They are more than anything, I would argue, a material archive of labels, of paper tools or past experiences that have become petrified in an assemblage of minerals, oils and plant fibers, and are thus able to cross time and space to evoke the presences which once gave rise to their inscription. By transforming the natural world into paper, to echo Latour & Woolgar's phrase, it becomes a stationary entity, an object subject to linear perspective, and thus viewable from many angles. This echoes Foucault's argument that what characterized the classical episteme was its rendering of objects onto visual planes of homogeneous space (Foucault 1973). Daston brings into the discussion the important addition of the idea of synoptic perspectivity, or of the view from above, which characterized the early modern mode of understanding (Daston 2014). Wherever there are objects there are perspectives, and perspectives, as Haraway shows, always emanate from concrete addresses (Haraway 1988). Thus part of the transformative potential of natural history lies in its ability to make nature into immutable mobiles (Latour 1986). While experience itself is pure flux, immutable mobiles hold still long enough to be argued over.

parishes where he functioned as a parson. According to Elizabeth Yale, "conversations with all sorts and kinds of people—husbandmen, shepherds, scholars, housewives, gamekeepers, groundskeepers, miners, scholars, and gentlemen—figured heavily in the production of natural historical and antiquarian knowledge"(Yale 2016, 91). If the first two pillars of natural history were observation and erudition, the third pillar was conversation. Through his profession White came into contact with a great number of people, and there is reason to believe his friendly and amiable disposition helped to maintain many of these relations over time. This network of informants provided him with knowledge in many forms. Through it he came to learn many of the intricacies of rural life, such as the manufacture or rush lights, why barking of felled timber was easier in the spring, or why high water in land springs usually spelled a bad corn harvest (Dadswell, Location No. 712). Local people, who were most likely aware of his work as a naturalist, frequently brought him wildlife reports, as well as live and dead specimens to be inspected. These people figure frequently in *Selborne,* where White treats their accounts with respect and recognition. They are not quoted like published scholars, but go by the names like an accurate correspondent, an observing gentleman, a very respectable gentleman, a person worthy of credit, or a very exact observer. White's informants formed a crucial ingredient of *Selborne* and complimented his first-hand observations and learned scholarship.[28]

We can say that Gilbert White's knowledge production combined three distinct but important strands. The first was experienced knowledge obtained by observation and experiment. This entailed a cultivated, practiced, impartial kind of attention which registered only the most essential details and kept qualitative remarks to a minimum. The second was written knowledge obtained through reading books and studying previous works in the field of natural history. Authoritative sources were given preference, but not if they contradicted observation, and consensus between sources was seen as the ideal outcome.[29] The third was

[28] Where there are several kinds of sources, or, if we are to indulge in the repertoire of cybernetic metaphors, where there are several kinds of inputs, it is important to consider the routing mechanisms which determine the ensuing output. In this regard, Latour has likened individuals to multi-conductors who process many claims, ignore some, modify others, and eventually pass the claims along (Latour 1986). This can also be seen in respect to his concept of institutions as centers of calculation. In this sense, naturalists such as White were a new kind of multi-conductor who were capable of parsing several kinds of information and producing the appropriate outputs. It is interesting in this regard to note that his paper on house-martins delivered to the Royal Society, makes no mention either of exact observers or persons worthy of credit. These are replaced by the phrase "it has been observed"(NHS 154).

[29] This underscores Elizabeth Eisenstein's argument that the scientific revolution originated not in the emergence of a new kind of mentality, but from the capacity to make knowledge moveable. The capacity to collate many different kinds of knowledges in one location had been limited in the pre-print world. The crucial factor concerning print, then, to use White as an example, is that the works of Ray, Scopoli, Buffon, Linnaeus, Bellon, Derham, Willughby, and Stillingfleet, who in a preprint world would be scattered in time and space, were now all present simultaneously in White's Selborne library and could be viewed by him. In contrast to manuscript,

tacit knowledge as it had been accumulated and stored in the ordinary practices of farmers, huntsmen, housewives, shepherds and fishermen. This knowledge was obtained through conversation, travel, and correspondence. When combined properly, they constituted a powerful repertoire of epistemic moves which would unleash an unprecedented capacity to operate upon the natural world.

Part 2: The Naturalist's Journal and Calendars of Nature

Introduction to Part 2

In the following I want to look at what underwrote and provided the foundation for much of the knowledge that was conveyed in *Selborne*, namely, the practice of recording nature events in the *Naturalist's Journal*. This will imply a change in source material. It can also be reiterated at this point that the study of cultural techniques not only takes texts or concepts as its objects of study, but also practices and how things have been done. In the following the central questions will revolve around the entanglement between mediation and temporality. The turn to media is important to clarify. My starting point is that the ontological ground of meaning is to be found in media.[30] The move performed here is to locate the articulation of difference not on the level of meaning, but on the level of mediation. Articulation of difference is perhaps the most basic epistemic operation possible. It says what is inside and outside, what is and what isn't. I want to argue that capacities of articulation are media effects, and thus give rise to specific enframings of being. As I look more closely at White's usage of the *Naturalist's Journal* and how it revealed the times of nature in new ways, this will be my central premise.

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print facilitates synoptic vision because of its ability to create many identical copies, which can then be collected in a single location and viewed by a single person. (Latour 1986).

[30] Media is being understood here in a broad sense. I understand language and the alphabet to be media, as well as the telephone or television. Saying that media is the ontological ground of meaning is simply to say that things like the invention of paper or the alphabet unlock new ways of articulating difference. The argument can be taken further, as done by Kittler, Heidegger, and more recently Wickberg & Gärdebo, to say that media have ontological implications, that is, they not only operate upon knowledge of the world, but also on being in the world (Kittler 2009, Heidegger 1977, Wickberg & Gärdebo 2020). I argue that adopting the framework of actor-network theory lends further support to this claim. In such a framework, entities are seen as relationally constituted, and media, as is made clear by its etymological roots as that which stands between, facilitate, uphold and produce relations between entities. Mediation plays a fundamental role in the thought of Latour, and thus the cross-breeding of ANT and media theory is an obviously logical move. Thus Siegert's statement that Latour is already a media theorist, although he may not identify as one (Siegert 2015).

Calendars of Nature

Calendars are particularly good to think with when inquiring about the relationship between time and media. Careful observation of the night sky allowed astronomers throughout history to know and manage the extra quarter of a day added to each solar orbit which lasts for 365 days and a fraction. Though the solar orbit makes itself known in other ways, such as the shifting seasons, variation in temperatures, and the height of the sun at noon, the shifting nature of such temporal cues only allows for the most approximate coordination of social activity. And so the night sky has long offered a more exact measure against which to coordinate collective social action. Thus calendars have served as mediators between the heavens and the earth for almost as long there have been urbanized civilizations.

In 18th-century England, novel attempts were initiated to use the calendar not to mediate between heaven and earth, but between science and nature. During this time there emerged several efforts to map natural rhythms onto the interface of the calendar. Equipped with paper tools, a greater sense of temporal precision, and the infrastructural apparatus of taxonomic systems, naturalists sought to represent the rhythms of hundreds of individuals species in terms of calendrical time through embarking on an extensive and time-consuming project of data-collection. A crucial factor in this development was the formulation of widely shared and standardized taxonomic systems which allowed naturalists to refer to plants, animals and insects with much greater specificity than common parlor alone.[31] White, for example, noted a total of roughly 400 specimens of plants, animals and insects in his journal.[32] Here it was the use of Linnaeus binomial nomenclature and Ray's classificatory system that provided the availability of labels necessary for the undertaking.[33]

There are a few notable examples worth mentioning here. First of all, there was Linnaeus' *Calendrium Florae* published in 1756, which comprised a description of the seasonal variations of plants that he observed during the year of 1755, both in the botanical

[31] The production of immutable mobiles was itself a crucial factor in this process, because once plants, animals and insects could be transformed into inscriptions, these inscriptions could be transported and made present in several locations. And so—this is the important aspect—they could be argued over. A taxonomic system is as much a network of alliances as a representational map, because its standardization and usage depends on aligning actors in arrangements of agreement and conformity. Without inscriptions, there are no tools with which to leverage claims about the natural world. Thus inscriptions are mediators which facilitate networks of alliances.

[32] Linnaeus classified a total of 10000 species using his binomial system, thus giving the field of botany a level of precision it had never had before (Stillingfleet 1762).

[33] White used Ray's system of classification for birds and Linnaeus' for plants. Even though having a taxonomic system at hand proved to be a great advantage in describing nature, using two parallel systems could often be difficult, as cross-referencing between the two often involved a bit of interpretation. Stillingfleet admittedly struggled with this in his *Calendar of Flora,* where he listed names from Ray and Linnaeus side by side (Stillingfleet 1762, 248). Over time compatibility was established as works using both systems were published, such as William Hudson's *Flora Anglica* in 1762.

garden at the University of Uppsala where he served as Professor of Medicine, and in the surrounding environment where he would go on observational field trips. The Linnean schema was simple, but was underpinned by a laborious process of data-collection. Big and small natural events were recorded, such as ice cracking on the Mälaren Lake, the appearance of flies, or the return of swallows or the flowering of the crocus. Accompanying each calendar date running down the page in a separate column were the natural events that had occurred on each given date of the year of 1755. Most of the time only the latin name was included, sometimes with a brief description of the type of event.[34]

In England, one of the early efforts to create a natural calendar was carried out by Benjamin Stillingfleet. In 1755, the same year as Linnaeus's calendar, he started writing the *Calendar of Flora,* which was later published in 1762 as an addendum to his *Miscellaneous Tracts Relating to Natural History, Husbandry, and Physick*, a collection of essays by various naturalists. Stillingfleet's calendar was inspired by the Greek botanist Theophrastus who, writing in the 3rd century BCE, had written a natural history of plants (Jankovic 2000). Stillingfleet extracted notable natural events from the work and inserted them into a sparse columnar presentation modeled on Linnaeus' *Calendrium*.[35] He also translated and included Linnaeus' calendar, as well as a calendar made by one of his students at Uppsala that had been published in the Uppsala press *Amœnitates Academicæ*.[36]

Roughly a decade before Stillingfleet began his work on the *Calendar*, Robert Marsham started recording the leafing dates of trees in his orchard and surrounding area, as well as other spring events, a project he continued to carry out for the next 50 years (NHS

[34] Similar projects took place elsewhere which are worth mentioning. In Norway, there was the naturalist-parson Jacob Nicolai Wilse who included a calendar of nature in his topographical work on his parish of Spydeberg (Wilse 1920). Wilse also adopted Linnaeus' division of the natural year into twelve distinct periods based both on the growth cycle of plants and on seasonal weather patterns. In Southern Germany there was the Mannheim Meteorological Society, whose yearly publications between 1780 and 1795 focused mostly on weather data collected by the 35 weather stations connected to the headquarters in Mannheim, but also included phenological observations of natural events (Cassidy 1985).

[35] Stillingfleet was in fact one of the first figures to introduce Linnaeus' system to an anglophone audience (Jankovic 2000, 94).

[36] Of note in Stillingfleet's work was the inclusion of coordinates of latitude and longitude. A total of four natural calendars are included in the work, two from Uppsala, one by Theophrastes in Greece, and one by Stillingfleet in England. Spatial coordinates were actually the entire raison d'etre of the work. Stillingfleet admits in the preface that he had more or less discarded his records of natural events as uninteresting until he saw the publications of similar calendars in the Uppsala press. He then realized that there might be something to be discovered in comparing the timing of similar natural events between different locations. His interest was piqued even more by the fact that the Swedish calendars and his own were recorded in the same year. This is undoubtedly a form of synchronization, albeit ex post facto, wherein paper inscriptions serve as the mediating envoys. By collating the four different calendars, Stillingfleet had inadvertently produced a new temporal scale. A single subject could now view, at a glance, a much vaster expanse of time. It could be argued, then, that scales that exceed the natural purview of the field of experience are the result of mediation. For more on synchronization, see Jordheim 2014, Jordheim & Ytreberg 2021, and Peters 2020.

vol. 2, 244).[37] Though he never published his results in book form, he eventually wrote up his findings in a paper which was read to the Royal Society in April of 1789. His records were also published earlier that year in *Philosophical Transactions* as a tabular overview tracking the dates of 27 spring events between 1736 and 1755 (Marsham 1789).[38] Marsham had initially received the impetus to initiate his project by his friend, the botanist Stephen Hale.[39] As the 18th-century headed into its sixth decade, there was thus already some work being done to map the rhythms of nature onto calendrical time. One of the prerequisites for these endeavours was the availability of paper tools, such as journals, diaries, tables and thermometers and barometers, which facilitated the collection of the huge data-sets required for the task. Both the move from the calfskin vellum to cotton rag paper taking place in the early Renaissance, and the technique of moveable-type printing systems which provided standardized designs for recording data in the form of tables, columns and grids, served as the essential infrastructural base for the 18th-century calendars of nature.

The Garden Kalendar

In 1764-65, Gilbert White acquired a copy of Stillingfleets's work (Egerton 2007). At this point, he had already maintained a journaling practice in his *Garden Kalendar* since 1751. While the *Garden Kalendar* certainly included much of the same kind of information as Stillingfleet and Linnaeus' calendars, its form and content was somewhat different. Undoubtedly this derived from its purpose as a gardening tool. It functioned primarily as a log-book detailing White's daily activities in the garden. The pages were blank, and White would start each new entry by noting the calendar date on the right hand side before filling in the information he regarded as necessary. Oftentimes this included what had been planted on a given day. The second most important topic was meteorology, as White would spend many entries describing the weather, which frequently meant noting unfavorable weather

[37] Marsham's earliest records go back to the year of 1736, which makes him perhaps the first English phenologist.

[38] White and Marsham only became acquainted with each other after the publication of *Selborne* in 1789. Marsham then wrote to White expressing his gratitude for the work. Of course realizing their shared interest they struck up a warm and friendly series of correspondences lasting until White's death in 1793. Thus said Marsham to White: "If it had been my good fortune to know you 50 years ago, I am sure I would have been a wiser, & better man: & I hope ' tis not too late now (NHS vol. 2, 257).

[39] There is in fact a thread tying together all the early British phenologists. Marsham had known Stillingfleet since college, and Stillingfleet compiled his calendar at Marsham's house in 1755. Marsham was encouraged by Hales to undertake his phenological project and Hales, apart from being a pioneer in botany who disproved the theory that plants have a system of circulation akin to the human pulmonary system, was a very good friend of Gilbert White who taught him many cutting-edge techniques of gardening, involving among other things ventilation. Furthermore, Stillingfleet dedicated his book on natural history to Daines Barrington's brother. Barrington eventually drew up the format for the Naturalist's Journal in 1767 based on Stillingfleets's schema (Jankovic 2000, 94).

conditions, such as unusual amounts of rain, heat or cold, sometimes accompanied by thermometer and barometer readings. But the notebook was also a place to do book-keeping, to write diary entries about dinner parties, or to document wine-making.

During the spring and summer of 1765, right around the time he acquired Stillingfleet's *Calendar,* a change in the *Garden Kalendar* took place. Where the *Garden Kalendar* had previously made little mention of living animals, except perhaps the odd bee or wasp flying around the garden, White now began to widen the scope of observed phenomena included in it. Thus he begins to record the first spring notes of birds, different bird sightings, and names of species of plants and flowers he has discovered in the surrounding forests, meadows and groves. The influence of Stillingfleet, in other words, is plainly evident. In August of 1765, he had already filled out a whole notebook and had to start a new one. This time he does not put as the title at the top of the first page the usual "Garden Kalendar", but instead "A Calendar of Flora, & the Garden from August 9th 1765". For the remainder of the year there is an overflow of notations. In the entry for October 28th 1765, he lists 40 plants still in bloom in the area of Selborne (Greenoak 1986, 166). Going into the following year, he made two books; one log-book for the garden work, and another book titled "Flora Selborniensis". The latter replicated exactly the format of Linnaeus' *Calendrium Florae* and depicted natural events concerning birds, plants, trees and insects for each calendar date of the year 1766. Each entry followed the same sparse form articulated by Linnaeus, usually consisting only of three words; first the common parlor term for what was described (the swift, gold-finch, woodruff), then the taxonomic label derived either from Ray's or Linnaeus' system (*Hirundo apus*, *carduelis*, *asperula*), and lastly a single verb describing the kind of event observed (returns, sings, flowers). In these efforts we see White's career as a naturalist beginning to take form.

In the following year of 1767, as White continued to carry out his data-collecting efforts, he was beginning to amass great amounts of information about the fauna and flora of Selborne. It was in this context that he struck up a conversation with the naturalist Thomas Pennant, who just a year earlier had published the important work *British Zoology,* in Benjamin White's bookshop on Fleet Street. Pennant, himself an established naturalist having made visits to many of the leading naturalists on the continent like Brisson and Buffon, had around this time initiated a new method of collecting information about natural history in particular locations by sending questionnaires to informants (Foster 1988, 81). And so after their encounter in Fleet Street, Pennant most likely realized the great utility of the data White

was collecting in Selborne, and thus pressured Benjamin White to urge Gilbert to correspond. Thus the two began an epistolary exchange that would last the rest of their lives.

The Naturalist's Journal

Also in the same year, the lawyer, antiquarian and naturalist Daines Barrington designed and printed the first edition of the Naturalist's Journal.[40] Paul Foster, one of White's biographers, holds that Pennant, who was an acquaintance of Barrington, encouraged Barrington to send White one of his copies. It is highly probable that the gift was warmly received. While the scope of White's naturalist project had widened considerably since *Flora Selborniensis,* and his correspondence with Pennant had brought a greater range of phenomena under his purview, the format of Linnaeus' *Calendrium,* and the idea of a calendar of nature, was still the main framework structuring his efforts. His method of using blank pages to track phenological data concerning a vast range of different plant and animal species was arguably less than ideal for this purpose. Here the chance encounter with Pennant in 1767, and the printing of the Naturalist's Journal in the same year by Barrington, proved to be a rare stroke of luck for White. While the Journal's eleven columns and seven rows were able to separate data-sets and create clear, distinct lines of synoptic overview, the heart of the Journal—its essential purpose—had to do mainly with time.[41] The three truly important columns, for

[40] The first records of the *Naturalist's Journal* being used is by the poet and naturalist Thomas Gray who began recording observations in the Journal in January of 1767. Similarly to White, Gray had been keeping a diary of nature observations since 1753 (Swedenberg 1939). He was also a friend of Benjamin Stillingfleet. Thus it is probable, seeing as Stillingfleet was connected to Barrington (see footnote 44), that the Gray-Barrington connection came about through Stillingfleet, and that he acquired the *Journal* in this way. Thomas Gray kept filling out the Journal until his death in 1771. There are many striking similarities between Gilbert White and Thomas Gray. While Gray spent most of his life as a literary scholar and poet at Cambridge, and traveled widely around England in his later years, White was of course a stationary naturalist-parson, but both seized on the medium of the written word to explore and express their encounters with the natural world. In both of their journals, there is the same detailed attention to natural rhythmicity, to the unique flowering times of each flower, to the particular calendar dates on which different birds commence their spring song. In both of their writings there is an appreciation of the fullness and richness of nature as it manifests itself in intimate details of the living, dynamic unfolding individual beings. In their writings attentiveness to temporal detail becomes an avenue for an appreciation of the sublime. While the affect being expressed in their writings is more subtle and sober than the later exalted sensibility of romantic poets like Wordsworth, both can rightly be considered pre-romantic writers. Thus it is not surprising that White's poem *A Naturalist's Summer Evening Walk* bears great similarity to Gray's poem *Ode on the Spring*, written more than forty years earlier.

[41] It is worth taking a moment to consider how the format of the *Journal* originated. As stated earlier, Jankovic claims that Barrington was inspired by Stillingfleet's schema in his design of the *Journal's* layout. But I think there is a greater debt owed to the layout used to present meteorological observations in the publications of the Royal Society in the preceding decades. Barrington became a fellow of the society in 1767 and would have been well acquainted with their meteorological treatises. In an age of information overload, to borrow a phrase from Ann Blair, tables were frequently used in the Society's publications to present anything from weather data, astronomical observations, to life expectancy statistics (Blair 2010). These examples reveal that tables came to be the go-to format whenever there was a large amount of data to be processed. While the Society used many different visualization formats to present large bodies of weather data, such as William Derham's observations from 1697 or George Hadley's observations from 1731-35, Barrington seems to have been particularly inspired

which the other eight were meant to provide contextual data, revolved around the timing of natural phenomena (Foster 1988, 85). Here one would record observations of "Trees first in leaf", "Plants first in flower", and when "Birds and Insects first appear or disappear". These data-points were very much in line with the calendrical project Stillingfleet had initiated in 1755. This project was essentially one of attempting to find in nature something that would indicate time as precisely as the movement of the stars or the mechanical clocks that were beginning to pervade the country. Infused with an infatuation of sorts with temporal precision, possibly brought on by the increased ability to manipulate time; to plan, coordinate and structure individual and collective social rhythms, facilitated in part by the proliferation of time-keeping devices like schedules, calendars, almanacks, diaries, clocks, and even pocket watches, it is not strange that many naturalists imagined that they could find within the shifting movements of nature something as precise and static, something able to keep time as reliably, as the clock or calendar.[42] Thus said Stillingfleet:

> "We see trees open their buds, and expand their leaves; from hence we conclude that spring approaches, and experience supports us in this conclusion, but nobody hitherto has been able to shevv what kind of tree Providence intended should be our calendar, so that we might know on what day the countryman ought to sow his grain."
>
> - Stillingfleet 1762, p. 147

It was this hunt, then, for "a calendar that cannot deceive", as Stillingfleet once put it, in contrast to the social calendar, which could be shifted and transposed, as England had recently learned during their conversion to the Gregorian calendar, that characterized the

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by the format adopted by John Lock in his observations from 1691 (Daston 2014, 188; Hadley 1743, Locke 1705). Both the *Journal* and Locke's weather table follow the exact same sequence of data fields; temperature, air pressure, wind direction, rainfall, and a brief weather description.

[42] The interest in natural calendars displayed by the figures mentioned thus far, namely, Barrington, Stillingfleet, Gray, Marsham, and White, occured in the same decade as the biggest calendar reform in England since antiquity. Up until 1750, England had used the Julian calendar. Most other countries in Europe, however, shifted to the Gregorian calendar during the 16th and 17th centuries. The raison d'etre of the Gregorian calendar was to abate the increasing separation between the actual occurrence of spring equinox, which ushered in the celebration of Easter, and the true date of Easter deriving from its date at the time of the First Council of Nicaea, on the 21st of March. The method employed by the Julian calendar of aligning the true solar year, lasting 365.24219 days, with the calendar year, lasting 365 days, was to add a leap day every four years. But this method was not actually accurate enough, with the result that the calendar gained one day every 128 years, and as the centuries passed the occurrence of spring equinox drifted further and further away from the true date of Easter. By 1750, the two events were 11 days out of sync. Thus the Parliament of Great Britain put in place The Calendar (New Style) Act 1750, which removed 11 days from the year of 1752, and changed the start of the new year from 25th of March to the 1st of January. While the interest in natural calendars occurring around the same time can not be traced back to this circumstance, because there were certainly many other factors altering the temporal landscape of England around the middle of the 18th-century, like the proliferation of mechanical clocks, and the rising trend of writing nature diaries, the sudden shift of the official calendar must have served to highlight the arbitrary and constructed nature of the calendar. Perhaps it made sense, then, to search for stability elsewhere.

work of arriving at a calendar of nature. The belief in nature's invariable regularity was a significant part of this endeavour. "Wonderful is the regularity observed by nature!", White writes in one of his letters (NHS vol. 2, 280). This attitude is most evident in his use of the phrase "punctual". On three separate occasions, all of them concerning the question of migration, he observes that birds are "most punctual" in their migration. He also remarks in a journal entry on the scarab beetle that it makes its yearly appearance the 26th of June and that "they are very punctual in their coming-out every year"(NJ 27.06.1791). In the same manner, he marvels at how the swallows and house-martins depart from his area before the middle of August "invariably"(NHS 28).

During the autumn of 1780, White discovered a large flight of swallows and deliberated to pay "uncommon attention to these late birds" and "to determine the precise time of their retreat"(NHS 248). After observing them closely for two days, he found that the time of "their evening retreat was exact and uniform." In another passage in one of his letters to Pennant, he describes his astonishment concerning the nightjar, who is "most punctual in beginning it's song exactly at the close of day". It was, in fact, so exact that he had more than once heard it strike up its song exactly at the same time as the report of the evening guns at the naval base in Portsmouth (NHS 65).[43] Of note in these passages is the use of terms like exact, regular, precise and punctual. One thinker who is able to shed light on what is going on here is the historian of science Alexander Koyré. One of Koyré's enduring contributions to the historiography of science is the idea that the advent of science implied more than just technological innovation and the utilization of a new method of inquiry, but that it entailed a profound shift in mentality and orientation. What took place in the early modern era, says Koyré, was the geometrization of space and the mathematization of nature (Drosdova et. al. 2018).

From a World of the Approximate to a Universe of Precision

This framework is useful for unpacking the implications of the 18th-century calendars of nature. While previous authors writing on phenomena such as leafing times, indications of spring, or bird migration, had been content to give temporal coordinates in more approximate terms, Gilbert White's *Selborne* is littered with calendar dates. A word frequency search for numerical calendar dates in *Selborne* reveals that White used calendar dates roughly 60 times

[43] This fascination with the punctuality of nature was shared by his brother in his work on the natural history of Gibraltar. He remarks in a letter to Linnaeus that the first appearance of the scorpionfly had occurred precisely on the 18th of May in each of the three years he had been observing it (NHS vol. 2, 75).

to describe natural phenomena.[44] If one looks at previous works that have touched upon the question of bird migration, such as Aristotle's section on birds in *Historia Animalium,* the 1240 treatise on ornithology by Holy Roman Emperor Frederick II *On the Art of Hunting With Birds,* or the 17th-century ornithologist Willughby's work *The Ornithology,* they employ a temporality that is relational and nature-based.[45] In other words, they tend to use phrases such as "in the summer", "early spring", or "mid-March". These ways of locating phenomena in time are not only approximate, broad, and imprecise, but rely on other processes in order to make sense. Terms like spring or summer are relative terms; they vary from year to year and from place to place. Terms like mid-March are vague and ambiguous. The numerical sequence of dates in the Gregorian calendar, however, is static. Each year has just as many days, and March always has 31 days in it.

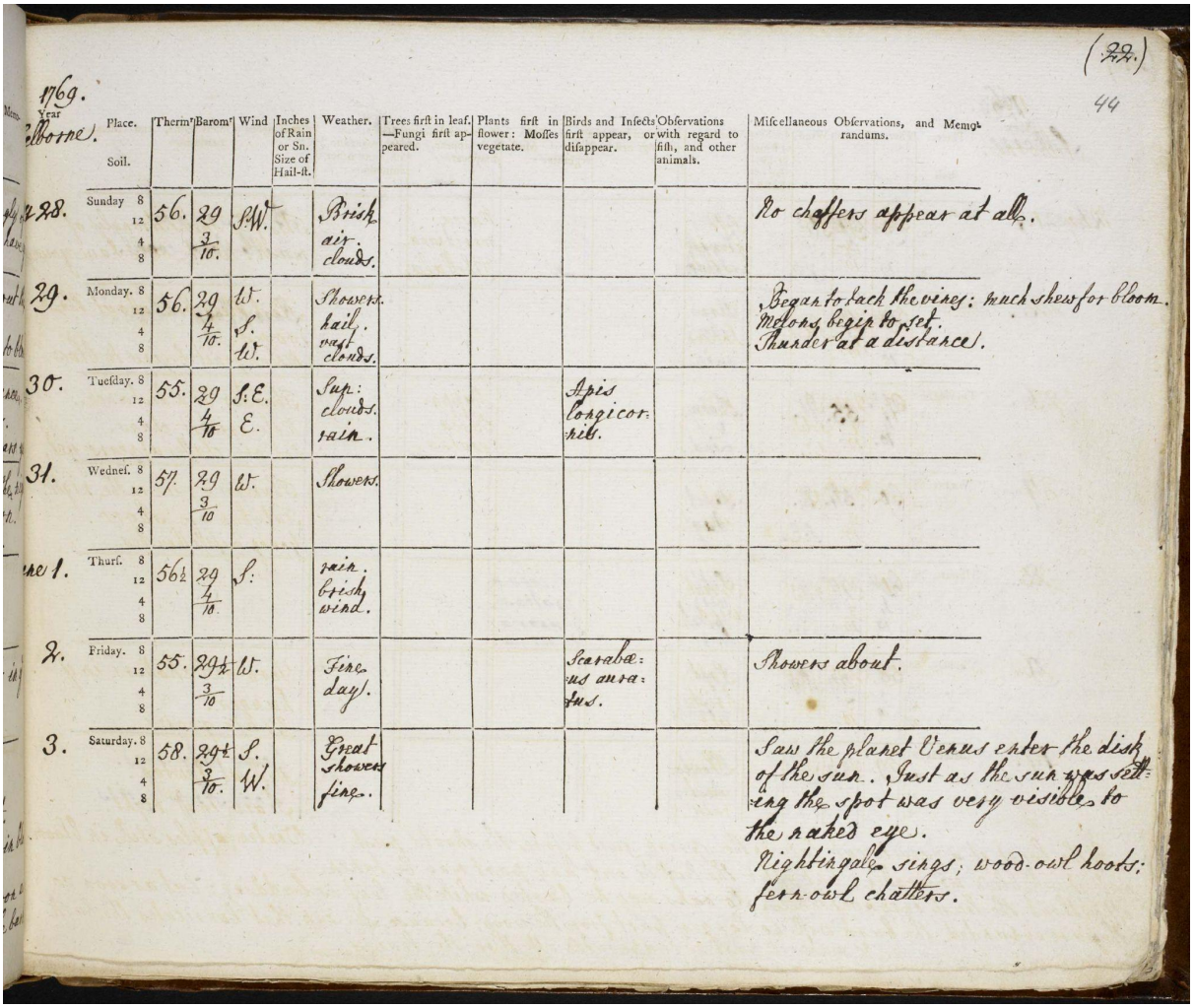
While the calendar may not be as absolute as Newton's concept of time, which according to him was independent of anything exterior, it still represents a significantly more abstract way of dealing with time than time-reckoning based on rhythms of nature or using prefixes such as early, mid, or late (Jordheim 2021).[46] One key difference here is the precision which utilization of calendar dates affords. But this precision comes at a cost. In the transfer from the realm of natural rhythmicity to the realm of calendar dates, which is a transfer between realms pertaining to different ontologies, there is a loss, a reduction, a translation gap. In drawing up a natural calendar time is represented spatially, in two dimensions, on a flat surface. This allows for an event to be extracted from the web in which it is entangled, as well as from the unbroken flow of experience, and to be given an isolated, separate, distinct location in a physical coordinate system. This simple and inconspicuous, yet highly consequential move, assumes that an event can in fact be separated from all of the events with which it co-occurs without there being any notable consequences; as if the event existed all by itself, as if its unfolding within a larger web of events was a trivial, accidental, and unimportant feature. This is what Whitehead calls the fallacy of simple location (Santos

[44] The number is not absolutely exact. Some of these calendar dates concern weather phenomena, but the vast majority concern birds.

[45] For Aristotle's discussion of migration, see Book 8, part 12 in Thompson's 1910 translation (Aristotle 1910) For an example from Frederick II's work, see page 841 of the Italian translation by Wood & Fyfe (Frederick II 1943). For Willughby, see *The Ornithology* (Willughby 1678).

[46] In his work on the medieval scholar Bede the Venerable, Helge Jordheim has shown how Bede conceives of three different kinds of "exteriors" underpinning the different scales of time (Jordheim 2021). The exteriority which defines the year derives from the stars and the waxing and waning of the moon. Thus it is based on nature. The exteriority which defines the month and its 30-day length is of a slightly different nature, as it is a convention that has been handed down since the Egyptians who first defined it. Thus it derives from tradition. The exteriority which defines the week is of a more arbitrary nature, Bede surmises. Ultimately it is derived from the church and the seven days of creation. Thus it derives from authority. Jordheim points out that the seamless transitions between these different timescales was ensured by Christian dogma.

2007).[47] The spatial equivalent of the fallacy of simple location is responsible for the illusion that an object can be described independently of its situatedness within a wider fabric of existence, as if it could be extracted, displaced, and relocated without the object undergoing any kind of significant alteration.



1769.
Year

	Place. Soil.		Therm[t]	Barom[t]	Wind	Inches of Rain or Sn. Size of Hail-st.	Weather.	Trees first in leaf. —Fungi first appeared.	Plants first in flower: Mosses vegetate.	Birds and Insects first appear, or disappear.	Observations with regard to fish, and other animals.	Miscellaneous Observations, and Memorandums.
28.	Selborne. Soil.	Sunday 8 12 4 8	56.	29 3/10.	S.W.		Brisk air. clouds.					No chaffers appear at all.
29.		Monday. 8 12 4 8	56.	29 4/10.	W. S. W.		Showers. hail. vast clouds.					Began to tack the vines: much shews for bloom. Melons begin to set. Thunder at a distance.
30.		Tuesday. 8 12 4 8	55.	29 4/10	S.E. E.		Sup: clouds. rain.			Apis longicornis.		
31.		Wednes. 8 12 4 8	57.	29 3/10	W.		Showers.					
Apr 1.		Thurs. 8 12 4 8	56½	29 4/10.	S:		rain. brisk wind.					
2.		Friday. 8 12 4 8	55.	29½ 3/10	W.		Fine day.			Scarabæus auratus.		Showers about.
3.		Saturday. 8 12 4 8	58.	29½ 3/10.	S. W.		Great showers fine.					Saw the planet Venus enter the disk of the sun. Just as the sun was setting the spot was very visible to the naked eye. Nightingale sings; wood-owl hoots: fern-owl chatters.

Fig. 1. Photo: British Library. Copyright: Public domain

If we look at the layout of the Naturalist's Journal (Fig 1), the way White has made certain entries may be interpreted as committing the fallacy of simple location. In the 9th column, concerning when "Birds and Insects first appear, disappear", there are two events which are recorded. The first is the appearance of *apis longicornis*, or the long-horned bee, on the 30th

[47] Indeed, the fallacy of simply location rules out the possibility of temporality being one of the constituent features of beings. One might of course imagine, as Whitehead does, a different ontology wherein one of the essential features of beings is their temporality, i.e. that they are concrete occurrences which arise in relation to other concrete occurrences. Beings in this perspective do not exist in time, but are made of events which are linked up in chains to other events. For an informative discussion of Whitehead's philosophy of time, see Stengers 2011.

of May, 1769. The second is the appearance of *scarabæus auralus*, a species of scarab beetle, on the 2nd of June. Each of these are inscribed inside their appropriate and proper boxes. What is important to note about the boxes on the journal page is that each box is produced as the horizontal rows, representing a synchronic slice of time, intersect with the vertical rows, which represent different kinds of entities. The conjunction of synchronic time-slices and different entities give rise to different kinds of events. One could say that the boxes that are produced in this way each house a unique category of event, whether that be a temperature event, an air pressure event, a rain event, a plant event, and so on. The logic of the grid is such that it separates events from each other; a rain event is recorded separately from a plant event, and a temperature event is recorded separately from a weather event, etc. I would argue that insofar as White follows the logic of the grid, an example of which being his records of the long-horned bee and the scarab beetle, he commits the fallacy of simple location. In this regard, the physical layout of the journal can be seen as promoting and inviting the fallacy of simple location.

However, the matter becomes more complex when one looks at the column titled "Miscellaneous Observations and Memorandums".[48] This box does not house a specific kind of event. Rather, it is a place where White allows a certain kind of freedom, flexibility, and at times even literary flourish. Here events are mixed up, tied together, placed side by side, and nature and culture, individual and social, personal and public, qualitative and quantitative, are all described and expressed in the same breath. Aesthetic delight and precise depiction rest easily in each other's company, and subjective narrative and objective measurement fraternize with effortless ease. Thus it is illuminating to read his entry on the 3rd of June (see fig. 1). Here he writes: "Saw the planet Venus enter the disk of the sun. Just as the sun was setting the spot was very visible to the naked eye. Nightingale sings; wood-owl hoots; fern-owl chatters"(NJ 03.06.1769). Astronomical events were of course not intended by the designer of the journal to form part of its scope, but White records the Venus transit nonetheless.[49] The transit is juxtaposed in the same entry with observations of the nightingale, wood-owl and fern-owl. Thus the strict separation of events which the format of the journal otherwise commanded was not obeyed. In other entries in the "Miscellaneous" column, White mixed

[48] As David Weinberger has argued, the categories of "miscellaneous" and "various" guarantee the consistency of any classification system (Weinberger 2008). Seeing as no classification system is able to fit everything into its categorizing scheme, the "miscellaneous" category functions as a placeholder for all the surplus phenomena not capable of being registered by the system, and saves the system from accumulating incoherence.
[49] Astronomical observations were on the other hand of great significance in the farmers almanacs, which followed a long-standing tradition of seeing the movements of planets as omens spelling either fortune or hardship (Chapman 2007). The very fact that astronomy is omitted from the journal, and also largely from White's scope of inquiry in general, indicates a shift in understanding.

events as he saw fit. On the 10th of June, 1778, he wrote, almost in a poetic, impressionistic form: “Full moon. Sweet summer’s day. The laburnums are in bloom, & high beauty. Wheat begins to push a few ears”(NJ 10.07.1778). Though one of the advantages of the *Journal* was that it allowed the entry of discrete events as isolated data-points which could later be accessed in a synoptic overview, this entry, which incorporates aesthetic description, shows how the miscellaneous category permitted a wider scope of observations.

But the co-existence of the different kinds of observations within the *Journal* exemplifies an emerging tension. Here I want to argue that the format of the *Journal*, in its insistence on the discreteness of events, served to intensify and exacerbate a tension, characteristic of natural science at the time and evident in the examples showed above, between a descriptive language based on quantification, precision, and separation on the one hand, and on the other a descriptive language that was qualitative, approximate and relational. The condition of possibility for this tension was a process not entirely identical to the mathematization of nature which Koyré speaks about, which pertains mostly to physics, but a similar kind of process, with a similar kind of structure, involving increasing abstraction and differentiation, taking place in natural history. We could perhaps say that while figures like Galileo and Descarte geometrized space, those who were involved in making calendars of nature punctualized the times of nature

Instead of measuring the times of nature in relation to the seasons or relative calendar placements, which involved saying things like that the crocus vernus bloomed in early spring, or that swallows migrated around mid-August, such processes could now be measured using a numerical sequence of calendar dates. While numerical calendar dates had been available for a long time, the crucial factor here was the introduction of tools for formatting and collecting data. These tools comprised things such as tables, printed journals, and taxonomic systems. This allowed naturalists to track the rhythms of hundreds of species of plants, animals and insects over greater periods of time, documenting with hitherto unprecedented precision the individual rhythms of each. This represented a move from a way of construing times of nature as approximate to construing the times of nature as exact. The timing of natural phenomena could now be described with a greater degree of granularity than before. This is in line with how Alexander Koyré describes the project of modern science. “Modern science constitutes itself,” he says, “in substituting for the qualitative, or more exactly, for the mixed world of common-sense (and Aristotelian science) an Archimedean world of geometry made real”(Koyré 1957, p. 223). It constitutes itself, he continues, “in substituting for the

world of the more–or–less of our daily life a universe of measurement and precision"(ibid.).[50] While Koyré is mainly concerned with transformations of space occurring in the early modern era, his argument can be applied to transformations of the times of nature as well. They too substituted the world of the approximate with a universe of measurement and precision.

But such transformations do not take place on an abstract level. Temporal and spatial awareness are not transformed between the lines in Newton's *Scholium.*[51] Such changes emerge out of concrete operations, involving material tools, communication infrastructures, techniques of information processing and methods of formatting data. They are the end-result of innumerable micro-processes of moving things and ideas around in circuits circumscribed by mental and material infrastructures. I would argue,then, that the temporal precision achieved in the *Naturalist's Journal* can be seen as arising out of specific chains of operations. In the *Journal*, the times of nature were inscribed in a specific way which allowed natural events to be represented visually, but the process of their inscription was constituted by a series of steps which are apt to escape one's attention unless investigated more closely. The *Naturalist's Journal* was itself composed of many separate techniques which became blackboxed in its application. Thus it is necessary to slow down the transformation of natural events into inscriptions, to open up the blackbox in other words, in order to gain a better view of the transformative capacity of each distinct technique. In the following I want to unpack five cultural techniques that I have identified in the *Journal.*

A *Naturalist's Journal* in Five Steps: Transformations and Affordance

As a preliminary working hypothesis of how the *Journal* constitutes time I propose the following argument. In order to register data-points in the *Journal*, such as temperature values and species of plants and animals, these need to undergo a process of stabilization. Once stabilized they are able to amplify the restricted bandwidth of the phenomenal world they purport to represent. But another step is required to operate upon the signals thus

[50] Koyrè's narrative is of course a grand narrative and should as such be treated with a healthy measure of caution. One might also look at early modern science and see a completely different, but equally valid, grand narrative; not the transformation of nature into abstraction, but the rise of Romanticism and the transformation of nature into sublime beauty One hypothesis worth exploring is that the mathematization of nature and the aestheticization of nature arise simultaneously, and that by severing the ties between the true and the beautiful, each was allowed to unfold their unique characteristics more fully.

[51] Certainly they are transformed there too, but the *Scholium* is just one site among an innumerable number of sites where such changes take place. Temporal and spatial awareness in the 18th-century were always being negotiated within a messy and crowded world of books, sermons, feasts, elections, factories, stage-coaches, postal systems, clocks, newspapers, hourly wages, calendars, maps, oceanic trading routes, and scientific discoveries.

amplified. They need to be assembled and aggregated into a whole. This is where the grid format enters the picture. The grid's two axes serve as the space of representation which allows the stabilized entities to be connected in various ways. These are the three steps of transformation. Once the stabilized and amplified entities are aggregated within the space of representation there appears an emergent affordance. This is the ability to write absence. Together they form a repertoire of five cultural techniques which underlie the *Journal's* ability to constitute time.[52]

Stabilization and Amplification

The *Naturalist's Journal* is a complex aggregate entity. It consists of many different elements. Just like a cake, it is composed of various kinds of ingredients. But ingredients, one might add, do not simply lie scattered around in small bundles and heaps, ready to be collected and made into cakes. Ingredients need to be manufactured. So too it is with the ingredients that make up the *Journal*. Temperatures, air pressure values, species of plants, birds and insects, do not simply exist as such in the larger world. Degrees of Fahrenheit or binomial nomenclature terms are not ready-mades which populate the world, waiting to be picked up by scientists. They too must be manufactured. Before there can be measurements of degrees in Fahrenheit there must first be assembled networks of more or less similar devices, agreed upon procedures, and not least measuring individuals, linked up in reciprocating chains. In Gilbert White's time, such networks were far from standardized. In his 1778 treatise *Dissertation sur la Comparaison des Thermometres*, the Dutch scientist van Swinden compared over 60 different kinds of thermometers in circulation in Europe at the time (van Swinden 1778). Production qualities could vary, with the result that thermometers from the same producer could show different results in similar conditions. White, whose meteorological records form an unbroken series between 1768 and 1790, expresses his frustration in this regard after having hung up two thermometers by different producers next to each other and finding that there was a difference of four degrees (NHS 267).[53]

[52] Identifying what is a cultural technique can be a challenge. In his doctoral dissertation, Johan Fredrikzon identifies three significant cultural techniques which underpinned the digitalization of Swedish society in the 1970's (Fredrikzon 2021). These were modelling, linking (of facts) and recycling (both of materials and information). In her work on the relationship between thinking and visual diagrams, Sybille Krämer highlights the cultural technique of flattening (Krämer & Ljungberg 2016).

[53] White's interest in conducting thorough meteorological investigations partly came from his close relations to Thomas Barker, known as "the father of meteorology". Barker, who kept a detailed weather diary most of his life, starting already in 1736, was the husband of White's sister, and the two corresponded closely, often involving White asking Barker's advice in meteorological matters (NHS vol 2., 100). White was not always around to conduct the readings, but in his absence he would employ his servant, Thomas, to make sure that the readings were made (NJ 22.06.1790)

It is useful at this point to reflect upon what a thermometer actually does. Before the arrival of reliable thermoscopes in the 17th-century, references to heat or cold necessarily remained vague. The decisive moment came when it was discovered that certain liquids, such as water, alcohol or mercury, would behave more or less consistently in closed glass tubes. What was produced, then, can be thought of as a chain of mediations. In the thermometer, air interacts with the liquid in the glass (first instance of mediation), which is put into relation to a numerical scale running vertically along the glass (second instance of mediation), which produces a given value which, in White's case, is noted in the *Journal* and thus put into relation to other elements (third instance of mediation). Now you have an amplified signal which can be reliably read by an observer.[54] Heat or cold could of course be read in other ways, such as through bodily sensations, or by noting its effects in the environment, but the signal-to-noise-ratio in such readings is unfavorable. The reliability of the mercury tube, on the other hand, reduces the amount of noise and produces a clear signal. This is what I mean by amplification. This was a necessary step in White's act of noting the weather, which involved a continuous transformation of things into inscriptions, which could be transported, compared and verified by observers distant both in space and time.[55]

I would argue that a similar process takes place in the employment of taxonomic systems. As I've indicated earlier in the discussion about the willow warbler, the ability to make precise references to beings in nature using common parlor alone was limited. Thus it was important to clarify whether there were actually three species of willow warbler and not two, as had hitherto been presupposed, and to give the new species a label. When White argues for the existence of a third species, he says "In these there is again an instance of some very common birds that have as yet no English name"(NHS 29). They don't have a name, and thus they can not be registered. The signal-to-noise ratio, in other words, is too low. This is an example of how the apparatus of taxonomic systems operate upon the natural world to reduce noise and amplify signals which can then be reliably interpreted, communicated, and

[54] While I did not consult Latour's work while I was formulating the concept of amplification, I believe he describes a similar kind of process in his discussion of the discovery of an optical pulsar (Latour 2016). Using a radio telescope, three scientists at the Steward Observatory in Arizona were sitting around a computer screen trying to detect the presence of the Crab nebula. Suddenly the graph on the screen shows a protrusion. "You don't suppose that's really it, do you? Can't be," says one of them. But protrusion keeps growing. "It really looks like something (from here) at the moment," says his colleague. Soon after they realize their momentous discovery. The real hero of the story, however, was the computer of average transients, a machine whose sole purpose was to receive an input and reduce the signal-to-noise ratio.

[55] White would regularly exchange weather information with correspondents around the country. These included Thomas Barker in Rutland, Benjamin White in Lambeth, John White when he lived in Lancashire, and also before when he was stationed in Gibraltar, Robert Marsham in Norwich, as well as other correspondents in Blackburn, Lancashire and Manchester. See *Selborne* p. 266 for a comparison of temperature between five locations on the 2nd and 3rd of February 1776.

represented. The amplification thus achieved can be seen as one of the conditions of possibility for making phenological records in the *Journal* as only clear signals, that is, clearly demarcated species, could be appropriately entered into the *Journal'*s format.

Aggregation

After phenomena have been stabilized into entities, which often means converting them into inscriptions and circulating them within networks, and then amplified, which often means pointing some kind of apparatus whose function is to increase the signal-to-noise ratio at a given slice of the phenomenal world, then there arises a new issue. How can they be fitted together? Once the data is produced, there must be a representational space capable of holding it. Here the format of the lattice grid serves an important function. As mentioned earlier, one of the issues of 18th-century natural science was the question of what to do with the huge data-sets emerging from the new fields of meteorology and phenology. The question related to how to create formats both for recording such data, and for presenting it. A case in point here is the fact that White made roughly 700,000 entries in the *Naturalist's Journal* between 1768 and 1793 (Foster 1988). Streamlining the process of both entering and reading entries was therefore paramount. My point here, however, is to emphasize that coherence within data-sets is a local, constructed and technologically mediated effort. This claim is inspired by the contrast between the *one level standpoint* (1-LS) and the *two level standpoint* (2-LS) outlined by Latour et. al. in their article on Gabriel Tarde (Latour et. al. 2012). Their argument, flippant and irreverent as always, is that "there is never any whole". While the 2-LS claims that parts aggregated together at some point become a whole, the 1-LS standpoint argues the opposite; that no matter how hard you search, you never run into something that registers as the whole, or things such as context, society, the state, the collective, etc. What you might encounter, however, are *collections*, i.e. deliberate gatherings of parts or their attributes. This is what they refer to as the 1.5-LS standpoint.

The 1.5-LS standpoint claims that whenever we encounter a whole, what we are encountering is the viewpoint of an association seen from the point of view of another part which has been made into a site of aggregation. In all one's readings one will thus never run into something that registers as "the context of 18th-century natural science", but one might run into a text which has aggregated a lot of other texts so as to gesture toward their association. Similarly, in all one's seeking one will never encounter something that registers as "the Earth", but one might for example run into an image taken from a satellite. What is encountered there, however, is another association of parts as they have been gathered by the

technologically mediated mode of vision of the satellite. There are no wholes. Only parts with the ability to assemble views of associations within themselves. This move is a valuable move because it allows a higher degree of analytical specificity. Confronted with a purported whole, which happens to be a data-set in our case, one can then ask; what is the concrete apparatus, and the specific work being done by each of its elements, which produces this synoptic view? It reverses the gaze 180 degrees. Instead of taking the synoptic view as it is, as simply a transparent gaze upon a world whose being is essentially independent of techniques for eliciting its presence, one refuses its transparency and looks backwards to its point of origin and to the materially embedded representational mechanics which are its condition of possibility.[56]

The ability of the lattice grid to aggregate disparate elements comes from the two fairly simple tenets which underlie it. One thinker who is instructive in this regard is Foucault. He was a thinker who clearly saw the important role played by tables in early modern knowledge production (Foucault 1973). To know something in the classical episteme was to spread it out on a surface. John Law adds that this allowed for the subject to escape "the linearity and the syntax of text by virtue of its construction as an overall vantage point"(Law 2002). And he continues: "This means, to use another metaphor, that a table draws things together." How does it draw things together we might ask? Through juxtaposing all the different elements—temperature events, bird events, insect events—onto a singular plane and subjecting them to the synoptic gaze of a single viewer, it orders them and posits some kind of association between them. But their juxtaposition implies more than similarity. It is more specific than that. The principles underpinning the *Journal* consist of the two basic tenets that rows imply one kind of information and columns another. The value, in other words, of what is entered in the rows and columns respectively is already specified in the design. The value prexists specific entries. In our case, the value of the Y-axis concerns time. That is the kind of information it imparts on each entry. The value of the X-axis concerns object type. That is the kind of information it imparts on each entry. But what is important to note is that neither axis makes sense on its own; it is in their transposition that each entry begins to make sense. Thus in the intersection of each axis, in the interaction between

[56] Daston makes the claim that "the challenge to self-consciously scientific experience in the latter half of the seventeenth century was to create a super-observer, compounded of many individual observers scattered over time and space"(Daston 2014, 8). I would add that the super-observer also needs a body so that it can travel around and convince others of its perspective and build alliance-networks in the process. Meteorological and phenological tables, I would argue, are precisely such bodies of super-observers. If they do not compound individual observers scattered in time and space, they compound disparate states of the same individual scattered in time.

synchronic time and object type, there arises event types. Such are the representational mechanics which conjure forth the synoptic perspective of the *Journal*, which is a synoptic view of time because it affords the viewing of many events simultaneously.

These fairly straightforward principles, involving dual valuation of data-entries, are what allowed the *Journal* to function as an aggregating site for the 700,000 entries White made. As he was writing *Selborne,* or even just corresponding with his acquaintances, he would consult his stack of completed journals (each composed a year) in order to find information about the appearance or retreat of a given animal, insect or plant. And by trailing the line of calendar dates vertically with his eye until he found the correct place to stop, and then following the synchronic slice of time horizontally, he could efficiently retrieve the piece of information he was looking for. Or alternatively, he could stay within a vertical column and follow it down the page to see unfolding trajectories of things like weather and temperature. Thus the vertical and horizontal lines guided not only the eye of flesh across a physical surface made of paper, but also the eye of mind across a cognitive space made of information. And all the while the lattice grid provided the architecture which facilitated and upheld the space of representation within which such movements were made. It was this architecture, simultaneously cognitive and material, which enabled the possibility of seeing at a glance the weather for a whole month, or whether there had been spotted house-martins in November. It was the main mechanism of aggregation behind the *Journal* which provided the space of representation capable of holding all of the amplified entities. Once it is seen how the information architecture of the *Journal* operated upon its entries to produce certain kinds of data, it also becomes easier to see the specific kinds of possible operations that emerged. One of these was the ability to write absence.

Writing No-Time

Emptiness is hard to wrap one's mind around. And even harder to represent. As one approaches the thought of nothing, one is simultaneously approaching thought's border; its outermost edge and limit. That is perhaps why neither Greeks or Romans had a concept of zero in their counting systems, despite the great impracticalities it entailed for doing mathematical operations (Kaplan 1999). It was not until the 13th-century when Italian merchants imported the concept of zero from the East that European mathematics could start making the sophisticated operations the concept allowed. Thinking about zero is useful for our purposes because one of the most important features which the information architecture of the *Journal* afforded was its ability to write no-time. Here I draw upon Bernhard Siegert's

work on the role of the grid in cartography (Siegert 2015). One of the important features of the grid in the context of cartography, he claims, is that it deals just as efficiently with occupied as with empty spaces. Thus, whether you are an Spanish colonist in South America drawing up a design for a settlement, or a surveyor in 18th-century North America laying out plans for a township and preparing lots for sale, the gridiron pattern permits you not only to map things that are there, but also that there is something that isn't there. The grid, in other words, "presupposes the ability to write absence"(ibid.).

So too with zero. What is interesting to note, however, is that the kind of absence being written is particular to the sign system. Thus the absence written by zero is the absence of numerals, and the absence written by the cartographic grid is the absence of that which fills space. The work being done by that which signifies absence in these examples is much more than signifying that something is not there. By signifying the absence of an element within a system, it simultaneously exposes the ground of the system. The surface is scraped off, so to speak, effectively laying bare the depth which was there all the time, but had gone unnoticed. This has led the mathematician Brian Rotman to claim that there is a double-aspect to zero. It is first of all a sign inside the number system, but it is also a meta-sign, a sign which stands outside the number system (Rotman 1987, 13). Something similar is going on, I would argue, in the way that the *Journal* registers events. Just as zero reveals the ground of the numeral system, and empty space reveals the ground of spatiality, it is possible to ask: what kind of ground are the absences in the *Journal* revealing?

In order to reflect constructively upon this question, because it is certainly not within the scope of this text to provide a thorough answer, it is instructive to draw attention to the fact that the *Journal* is designed essentially according to a binary system.[57] Each box in the lattice grid is either marked or empty. Those are the two available options. There is no gradient space of nuances in between. Either the crocus vernus is registered as bloomed or not. Swallows are either registered as appeared or not. This binary system of registering events arguably derives from the physical properties of the lattice grid. Whereas linear syntax is unable to register absence except by describing it, the lattice grid can do so simply by virtue of its design. An empty box also signifies something.[58] And this brings us to a very

[57] I wish to thank Helge Jordheim for bringing up this notion in one of our conversations. The thoughts in this section can be traced back to that insight.

[58] It is important to underscore that the Journal was much more binary in its intended usage than was actually practiced by Gilbert White. While he maintained a habit of entering the sparse and neutral scientific species names in the three columns marked "Trees first in leaf", "Plants first in flower", and when "Birds and Insects first appear or disappear" up until around 1776, from that point onwards he takes up his custom, deeply ingrained as it must have been after 17 years of semi-structured journaling in the *Garden Kalendar*, of writing sustained comment in the "Miscellaneous" column.

important point. Not only was the *Journal* capable of creating new kinds of inscriptions due to its two axes which performed an act of dual valuation involving synchronic time and object type, the transposition of which gave rise to event type, but it was also capable of registering the absence of events.

This affordance was particularly useful for White in his attempt to answer the migration question. As he would return to his pile of journals to inquire when the house-martins or the swallows had last been seen in the preceding years, he was just as much as reading the absence of certain entries, as looking at entries that had been made. This comes to the fore in how he enters observations on swallows and martins. Over the years, as White became fixated upon the migration question, he began to pay close attention particularly to swallows and martins as the time of their migration approached. Thus in October 1778, we find many entries like the following; "Some nestling-martins are out, & the dams feed them as they fly about. Some swallows"(NJ 01.10.78). This latter phrase is repeated four times in the subsequent nine days. Sometimes it is the sole content of the entry, reading simply "some swallows" or "some martins". The entry for October 4th just reads "Swallows". Having used the *Journal* for a decade at this point, it is likely that White had realized its utility in providing a personal archive which could be queried in future years. Aware of the fact that there would be a time where he would want to look back upon the autumn season of 1778 to inquire about the migration of swallows and martins, he made sure at the time to carefully register their movements. But what really mattered, however, was when there was nothing registered. As one's eyes scan across the pages of the *Journal* and one looks upon the months of September and October of 1778, there is a noticeable increase in the attention paid to swallows and martins. This attention comes to a climax toward the middle of October. And then something happens. A point has been reached. Suddenly the swallows and martins are gone. They have disappeared. The eyes keep scanning, but they are nowhere to be seen.

After a long period of absence, come March there would appear the same spartan and precise entries. On the 6th of March: "Two swallows at Selborne." The entry is repeated again two days later. Then on the 11th of March: "A swallow at Faringdon." This pattern of an increased attention being paid to swallows and martins in the *Journal* in October/November followed by their disappearance and their return in March/April plays out again and again in subsequent years. What is really significant here, though, are the days when such entries are absent. Just as important as the event of their appearance is the non-event of their absence. And so we could ask: how can absence be made legible? How is it possible to read something that is not there? This is because of the *Journal's* ability to write

absence. When a box or a row remains empty in the *Journal* it is still a signifying emptiness. Even when the *Journal* is not inscribed, it is productive of a certain kind of information. This information is what White would query each time he looked back upon preceding years to ascertain the migration times of swallows and martins.

To take non-events and make them into legible data-points must then be said to be one of the emergent affordances of the *Journal*. Not only does the *Journal* choreograph the coming to presence of animals, plants and insects through specific modes of revealing, but it also conjures forth from the abyss of non-meaning a specific kind of time, which can in a provisional sense be called no-time. Building on Peters' statement that *entbergen* releases something that was implicit but in a very different form, I would like to argue here that the ability of the *Journal* to write absence releases a kind of empty time. One could think of this as the temporal equivalent of zero. And just as zero exposes the very ground of the numeral system, so too no-time exposes the ground of temporality. In the same way as zero is both a number, but also something that stands outside the number system, empty time, no-time, or the non-event, is both something that partakes in time, but also stands outside it. What is happening in the *Journal*, however, is that empty time becomes converted into legible data through its ability to write no-time. In this way, no-time becomes a workable magnitude, something that can be registered, read and measured. Just like zero domesticates nothingness and makes it into a corporeal element which can be put to work, so too the *Journal* domesticates no-time and gives it substance and visibility, allowing it to be wielded and processed. No-time becomes instantiated through the medium of the lattice grid which allows it to become inserted into chains of operations involving observation, inscription and transportation. It acquires a body capable of being incorporated into recursive series of iterations which traverse disparate domains, both cognitive, social and material.

Conclusion

In conclusion I want to return to the question of how the *Journal* served to constitute time. We can say that the ability of the *Journal* to constitute time, or, to phrase it differently, to reveal something that was implicit, but in a very different form, is made explicit once it is seen as a micro-network of technologies and techniques, consisting of thermometers, observations, taxonomies, calendar dates, and the lattice grid, to name just a few. This imbroglio of practices and instruments was situated within the broader effort taking place in late 18th-century England of making calendars of nature. On one level, White's project

revolved around tracking the rhythms of plants, animals and insects from year to year. But on a deeper level, the operations thus involved were ontic operations, i.e. techniques which made distinctions within the real. Through the actor-network which was its condition of possibility, the times of nature were rendered as precise rather than approximate, and became legible as an array of detached animal, insect and plant events with simple location which could be inscribed, transported, aggregated and viewed at a glance.

It should be clarified that I am not saying that birds or weather do not pre-exist chains of mediation. They certainly do. But they first become available to us within systems of technologically mediated distinctions. There is, one could say, a pre-existing abyss of non-meaning from which they emerge. The ways in which they emerge occur through what Heidegger calls "modes of revealing". Technology constitutes one of these modes. According to Peters, *entbergen* (revealing) for Heidegger "is not simply digging up; it is a releasing of something that was implicit but in a very different form[...]"(Peters 2015). And he continues: " Nature comes to presence on its own, but when nature comes to presence as knowledge or theory, the world is both imperiled and leveraged"(ibid.). To make something come to presence in a particular way is not to give it existence as such, but to reveal something that was hidden, to call something forth from the abyss of non-meaning. According to Heidegger, the modern era traffics in a special kind of revealing which sets it apart from other eras. This has to do with scientific representation. A quote from *The Age of the World Picture* bears it out:

> Knowledge as research calls beings to account with regard to the way in which, and the extent to which, they can be placed at the disposal of representation. Research has beings at its disposal when it can, through calculation, either predict their future or retrodict their past. In the prediction of nature and retrodiction of history, nature and history are set in place in the same way. They become objects of explanatory representation. Such representation counts on nature and takes account of history. Only what becomes, in this way, an object *is* - counts as in being.
>
> - Heidegger 2002, 65

In this perspective acts of measuring, inscribing, recording, and registering nature do not simply passively mirror or reflect a pre-existing reality. They in fact proscribe the conditions under which nature can be said to be. "Only what becomes, in this way, an object *is* [...]." The consequence of "picturing" the world has more profound consequences than simply

producing a particular rendering of it. Rather, “world picture" does not mean “picture of the world” but rather the world grasped as picture”(ibid.). I would argue that this could be extended to many of the sub-genres of scientific representation. To model the world is simultaneously to recast the world as model. To map a continent is simultaneously to recast the continent as map. To measure the time of nature is simultaneously to recast nature as measured time. Natural science calls beings to account, and like a tax collector, it exacts from the abyss of non-meaning the attributes of beings which its mode of revealing permits. And in a kind of figure-ground reversal, only that which is exacted “counts as in being”, rather than it being merely the thinnest sliver of the multitudes which populate the world.[59] In order to feed the world into your model, the world must first be converted into a format compatible with the model’s format. To put it simply: If all you can put into the model is data, then first you must construe the world as data.

In this thesis, I’ve attempted to shed some light on what “construing the world as data” might entail in the context of Gilbert White’s practice of recording natural events in the *Naturalist’s Journal.* It is, as I’ve shown, a heterogeneous practice involving several distinct steps, each of which transform and operate upon in specific ways the beings it ropes into its chains of operations. The *Naturalist’s Journal* was a tool which issued forth specific modes of revealing. It was the medium which stood in between the emergence of beings from subsistence into ek-sistence (Stiegler 2011). It was the transducer which choreographed their coming to presence. Transducers, one might add, are always wired in specific ways which have consequences for how they shape and transform signals. Thus a different lay-out, one without a grid and without calendar time, would have produced entirely different events. But because it had the form it had, the *Naturalist’s Journal* gave rise to specific ontological distinctions, involving encoding isolated events within the framework of calendar time, distinctions which then were liable to take over thought.

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[59] Someone like Graham Harman seizes upon this point and emphasizes that the vast majority of exchanges taking place at any given moment are actually taking place between things. Thus the turn toward object-oriented ontology (Harman 2018). Harman’s work may be situated within a broader development in recent years within academia called the ontological turn, most notably associated with figures like Latour, Descola and Viveiros des Castros (see footnote 26). While the figures associated with the study of cultural techniques are not often mentioned as part of the ontological turn, they share some important characteristics, namely, a sincere engagement with the real and that which is beyond representation. While Kant seems to have placed a moratorium on ontological speculation in Western philosophy, it seems that the thing-in-itself is becoming an object of investigation once again. Old habits are hard to break, however, and many of our languages are filled with metaphors based on the representational paradigm. Thus understanding or knowing is often spoken of in terms of vision. We speak of *clear* information, of *presenting* an argument, of *seeing* what is meant, and of taking multiple *perspectives* on an issue. No doubt the introduction of cognitive science in the humanities has also served to weaken the Kantian inheritance of phenomenological bracketing. A noteworthy example is the adoption of 4E cognition in the literary sciences. See for example Kukkonen 2018.

Ultimately this had great consequences for the process of writing *Selborne.* As I've said earlier, it is a work that is incredibly temporal. It has the calendar written all over it. Calendar dates are used over 60 times to discuss everything from the seasons, the weather, avian migration patterns, to the commencement of bird songs. This calendrical precision was the direct result of the use of the *Journal.* It allowed White to store and retrieve information efficiently, and it allowed him to track migrational patterns across greater timespans. In each instance of the discussion of the migration question in *Selborne*, we can perceive the presence of the *Journal,* which served as the foundation for so much of the knowledge White conveyed both to his epistolary interlocutors Pennant and Barringtons, but also to the readership which would eventually be attracted to White's nature writing in years following the publication of *Selborne*. However, it was not until England entered into the third quarter of the 19th-century that White's readership would start to grow. First a generation of Romantics, who perhaps found his language not exalted enough, and Linneans, who perhaps found his prose too imbued with feeling, had to come to pass before, as Allen argues, a new affluent middle class audience emerged who would appreciate "his gift of empathy, his ability to infuse deep feeling into what he described and recorded so carefully and soberly"(Allen 1976, 44). His work would eventually become one of the bestselling works of natural history in the 19th-century with over a 100 editions published between 1830 and 1900, and would continue to invite ever new generations of Victorians into his vision of a nature that was local, quaint and ordinary, but nevertheless deep, profound and permeated by the sublime (King 2019).

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