Wallace and Incipient Structures: A World of 'More Recondite' Influences

Charles H. Smith

Abstract Alfred Russel Wallace is well-known for his co-discovery of the principle of natural selection. Natural selection is usually considered a process, but it is not clear that Wallace regarded it in exactly these terms. In fact he more likely thought of the relationships involved as representing what we would now term a "state space," a negative feedback loop wherein populations are maintained at healthy levels through elimination of the unfit. Both before and after the advent of natural selection, Wallace clung to the idea that "more recondite forces" were shaping the nature and direction of evolution; this is especially evident in his treatment of incipient structures, and continuing allusions to the probable existence of extenuating local influences on process. In this work, the history of these leanings is detailed, in the hope that Wallace's overall position on evolution may be better understood.

1 Introduction

In February of 1858, Alfred Russel Wallace, weak with fever, had a now-famous epiphany. Recalling his field experiences of the past several years and adding to them the logic of Malthus, he came up with a principle, natural selection, which seemed to explain how populations might indefinitely move away from "original types." Pleased with his thinking, he decided to write up the idea as an essay and send it to Charles Darwin, who he knew through earlier correspondence, was interested in the subject. But his real target was Charles Lyell, whose theories on biogeography he had just challenged in a paper published in late 1857 (Wallace 1857), and to whom Wallace was asking Darwin to relay the manuscript if he thought it worthy. Wallace now had a theory that backed his criticisms, and he must have been very eager to receive some feedback. Fate intervened, however, and Lyell never

C.H. Smith (✉)
University Libraries, Western Kentucky University,
1906 College Heights Boulevard, Bowling Green, KY 42101, USA
e-mail: charles.smith@wku.edu

I. Das, A.A. Tuen (eds.), *Naturalists, Explorers and Field Scientists in South-East Asia and Australasia*, Topics in Biodiversity and Conservation 15,
DOI 10.1007/978-3-319-26161-4_1

responded: instead the essay was read before the Linnean Society 2 weeks later and published immediately, without Wallace's permission.

Although initially Wallace was overjoyed to receive this attention from two of the world's top naturalists, as time wore on he seems to have become less pleased about this treatment. Although too polite to be outwardly derogatory, he nevertheless drew attention no fewer than five times over the next 40-odd years, in print, to how he had never been given the option of going over proofs before the essay was published. Was there something more – or less – that he had wanted to say? Had he been prematurely cut off, and then unfairly cast as a "Darwinist," as opposed to just an "evolutionist"?

The ramifications of this question will never be thoughtfully explored if we continue to pay most of our attention to the Ternate essay in terms of sensationalist accusations of intellectual theft on the part of Darwin. Frankly, of what importance is this matter to Wallace studies? Does it help us better understand Wallace's intellectual path to that point? I think not.

In this paper, I will examine some threads of that journey that I feel go a long way toward explaining Wallace's words in the Ternate essay, and many of his subsequent directions. Let us begin by noting that Wallace himself regarded his principle not as a theory, but as a law (see Wallace 1870a: 302, and many other such referrals); accordingly, in Wallace's eyes natural selection was not so much the "survival of the fittest" as it was the "elimination of the unfit." Lest there be any doubt on this score, note the following Wallace words, three from published articles of his:

> Natural selection . . . does not so much select special variations as exterminate the most unfavourable ones (from an 1866 letter to Darwin printed in Marchant 1916).
>
> The survival of the fittest is really the extinction of the unfit. In nature this occurs perpetually on an enormous scale, because, owing to the rapid increase of most organisms, the unfit which are yearly destroyed form a large proportion of those that are born (Wallace 1890: 337)
>
> The survival of the fittest is really the extinction of the unfit . . . (Anonymous 1893: 3)
>
> It is undoubtedly this survival, by extermination of the unfit, combined with universally present variation, which brings about that marvellous *adaptation to the ever-varying environment* . . . (Wallace 1908a: 424)
>
> The survival of the fittest is really the extinction of the unfit . . . (Wallace 1913: 152)

Wallace's view of the matter is also evident in famous words he included in the Ternate essay itself:

> . . . The action of this principle is exactly like that of the centrifugal governor of the steam engine, which checks and corrects any irregularities almost before they become evident; and in like manner no unbalanced deficiency in the animal kingdom can ever reach any conspicuous magnitude, because it would make itself felt at the very first step, by rendering existence difficult and extinction almost sure soon to follow (Wallace 1858: 62).

In 1972 the anthropologist Gregory Bateson made a related observation:

> . . . The steam engine with a governor is simply a circular train of causal events, with somewhere a link in that chain such that the more of something, the less of the next thing in the circuit . . . If causal chains with that general characteristic are provided with energy, the result will be . . . a self-corrective system. Wallace, in fact, proposed the first cybernetic model . . . Basically these systems are always *conservative* . . . in such systems changes occur to conserve the truth of some descriptive statement, some component of the *status quo*. Wallace saw the matter correctly, and natural selection acts primarily to keep the species unvarying . . . (Bateson 1972: 435)

If Bateson is correct in this assessment (and I believe he is), Wallace's "negative feedback loop" view of the way natural selection operates must be connected to a complementary positive feedback process that pushes systems away from stability and incrementally toward higher levels of order (and probably, at some times, lower levels). I have argued elsewhere (Smith 1986) that this process is geographically nonrandom range change connected with the integration of populations into community structures, as influenced by varying-efficiency biogeochemical and hydroclimatological cycling processes inherent in the surrounding environment. I doubt that Wallace had any of these details worked out, but it is evident in his later writings that he felt that, somehow, the results that natural selection produced were relatable to causes found in characteristics of the environment, as broadly defined (i.e., including its biotic elements).

From what source did Wallace pick up this kind of thinking? Certainly not from any of the usual suspects: Charles Lyell, Robert Chambers (author of *Vestiges of the Natural History of Creation*), Thomas Malthus, or even Darwin. Lyell's uniformitarian views helped steer Wallace away from creationist, Lamarckian, and catastrophist thoughts, but Lyell was a geologist primarily interested in historical records, not ecological interactions leading to biological transformations. Malthus certainly provided some of the demographic pieces, but his writings were rather remote from any considerations of the natural environment. Who, then?

The answer is: Alexander von Humboldt.

2 Wallace and Alexander von Humboldt

Humboldt (1769–1859) was the most famous scientist of his time, and perhaps the most influential one as well. His method, "Humboldtian science," is succinctly described at the head of a *Wikipedia* entry:

> Humboldtian science incorporates many ideals and concepts, though it roughly encapsulates a shift toward an understanding of the interconnectedness of nature through accurate measurement. One central concept was what Humboldt called "terrestrial physics," which encompassed an extensive and pervasive study of the earth's many features and forces with accurate scientific instrumentation. Humboldtian science is founded on a principle of "general equilibrium of forces." General equilibrium was the idea that there are infinite forces in nature that are in constant conflict, yet all forces balance each other out.

It has been appreciated for many years that Humboldt was a major influence on Wallace's decision to become a traveling naturalist, especially as a result of Humboldt's *Personal Narrative of Travels*, dedicated to his expedition to South America, 1799–1804 (von Humboldt and Bonpland 1814). Wallace apparently became aware of this work (and possibly others of his such as *Aspects of Nature*) in the early 1840s. But he also became aware of another, Humboldt's crowning achievement, *Cosmos*, as its first volumes came off the press in the mid-1840s. Whereas *Personal Narrative* stuck more to the details of Humboldt's trip, *Cosmos* included a good deal on Humboldt's philosophy of nature, including remarks on the

abovementioned "interconnectedness of nature" and "general equilibrium of forces." In a 28 December 1845 letter to Bates, Wallace wrote: "As a further support to the 'Vestiges' I have heard that 'Cosmos' the celebrated work by the venerable Humboldt supports in almost every particular its theories not excepting those relating to Animal and Vegetable life – This work I have a great desire to read" (Wallace 1845). That he did read it is supported by several lines of evidence (Smith 2013), probably before he left for the Amazon in 1848, and likely no later than during his first months in the Malay Archipelago.

On opening Volume 1 of *Cosmos*, Wallace would have noted a good number of passages in its Introduction alone that would influence him for the rest of his life. For example, in a writing on spiritualism in 1871, he quotes from it, how "a presumptuous skepticism, which rejects facts without examination of their truth, is, in some respects, more injurious than an unquestioning incredulity" (Wallace 1871: 30). He featured this same basic admonition some 10 years earlier in a famous 1861 letter from the field on religious belief to his brother-in-law (Marchant 1916: 65–67), and other instances of the same thinking are sprinkled throughout Wallace's literary career.

A few more passages from the Introduction to *Cosmos* may be considered:

General views lead us habitually to regard each organic form as a definite part of the entire creation, and to recognise, in the particular plant or animal, not an isolated species, but a form linked in the chain of being to other forms living or extinct. They assist us in comprehending the relations, which exist between the most recent discoveries, and those which have prepared the way for them (Humboldt 1846: 23).

These sympathies re-emerge in the celebrated closing passage on biodiversity in Wallace's "The Physical Geography of the Malay Archipelago" (1863).

> Who will venture to affirm, that we yet know with precision that part of the atmosphere which is not oxygen, or that thousands of gaseous substances affecting our organs may not be mixed with the nitrogen? or who will say that we already know even the whole number of the forces which pervade the universe? (*ibid.*, p. 32: This previews Wallace's continuing allusion to "more recondite forces.")
>
> . . . those who are able to escape occasionally from the restricted circle of the ordinary duties of civil life, and regret to find that they have so long remained strangers to nature, may thus have opened to them access to one of the noblest enjoyments which the activity of the rational faculties can afford to man. The study of general natural knowledge awakens in us as it were new perceptions which had long lain dormant (*ibid.*, pp. 35–36: Wallace's two earliest known writings, *circa* 1841–1843, dwell on this very idea).
>
> . . . the final aim of physical geography is to recognise unity in the vast variety of phenomena, and by the exercise of thought and the combination of observations, to discern that which is constant through apparent change. In the exposition of the terrestrial portion of the Cosmos, we may sometimes find occasion to descend to very special facts, but it will only be for the purpose of recalling the connection existing between the laws of the actual distribution of organic beings over the surface of the globe, and the laws of the ideal classification by natural families, analogy of internal organisation, and progressive evolution (*ibid.*, p. 48).

It is not surprising to find that Wallace cites Humboldt 19 times (in five works) in his pre-1857 writings (and Lyell only twice). Nevertheless, Wallace was probably a bit disappointed on reading *Cosmos* to find that Humboldt was not a transmutationist. He would be left to find his own way in that direction.

Humboldt's influence on Wallace extended beyond direct connections. At least three of Humboldt's staunchest followers also had demonstrable impact on him: Lyell, Franz J. F. Meyen, and Justus von Liebig. Lyell's allegiance to Humboldt's method is evidenced by the several dozen mentions he makes of Humboldt in his most famous works, and Lyell's own attention to detail and measurement. Meyen and Liebig were outright protégés of Humboldt. Meyen (1846) refers to Humboldt some 75 times in his important 1846 book *Outlines of the Geography of Plants*. Liebig, famous among other contributions for his development of the limiting factor concept, dedicated his most influential work, *Organic Chemistry in Its Application to Agriculture and Physiology*, from 1840, to him (Liebig 1840). All three provided Wallace with ideas that undoubtedly influenced his thought during his Amazonian and Indonesian travels (Smith 2013).

Humboldtian science's effect on Wallace's thinking was a two-edged sword. While helping him evade dead ends such as catastrophism, creationism, and Lamarckism, it also moved him away from a useful understanding of the role of adaptation in evolution. Refusing to accept any connection between characters and specially created functions, for many years, right through to the Ternate essay, Wallace treated adaptations as secondary features that while somehow "correlated" with evolutionary advance had no causal role in the process. This is evident from lines in an article on the natural history of the orangutan he published in 1856:

> Do you mean to assert, then, some of my readers will indignantly ask, that this animal, or any animal, is provided with organs which are of no use to it? Yes, we reply, we do mean to assert that many animals are provided with organs and appendages which serve no material or physical purpose. The extraordinary excrescences of many insects, the fantastic and many-coloured plumes which adorn certain birds, the excessively developed horns in some of the antelopes, the colours and infinitely modified forms of many flower-petals, are all cases, for an explanation of which we must look to some general principle far more recondite than a simple relation to the necessities of the individual. We conceive it to be a most erroneous, a most contracted view of the organic world, to believe that every part of an animal or of a plant exists solely for some material and physical use to the individual, – to believe that all the beauty, all the infinite combinations and changes of form and structure should have the sole purpose and end of enabling each animal to support its existence, – to believe, in fact, that we know the one sole end and purpose of every modification that exists in organic beings, and to refuse to recognize the possibility of there being any other (Wallace 1856: 30).

Meanwhile, however, he was taking to heart other elements of the program inherited from Humboldt, Lyell, Meyen, and Liebig. He kept careful records of – everything – whether geographical distribution data, or catches for the day, or measurements of physical characteristics of the environment, or the vocabularies of the peoples he encountered. He was also embracing the philosophy; the last quotation given above alone contains multiple nods to Humboldtian thinking. A close examination of all of Wallace's writings through 1857 will doubtlessly turn up many more. As early as 1852 he had written:

> On this accurate determination of an animal's range many interesting questions depend. Are very closely allied species ever separated by a wide interval of country? What physical features determine the boundaries of species and of genera? Do the isothermal lines ever

> accurately bound the range of species, or are they altogether independent of them? What are the circumstances which render certain rivers and certain mountain ranges the limits of numerous species, while others are not? None of these questions can be satisfactorily answered till we have the range of numerous species accurately determined (Wallace 1852: 110–111).

Attention to measurement, as in all good Humboldtian science, is the central theme in this passage – and, it should not be ignored, Humboldt was the inventor of the isothermal line concept mentioned in it.

Eventually, of course, with the aid of Malthus and a creative approach to the concept of variation, Wallace was able to get past his hang-up over adaptations. Simply, and because of variation, characters could change in *whatever* way that might accrue competitive advantage. It should be noted, however, that Wallace's new appreciation of the function of adaptations in no way reduced his feeling that "the environment" was holding final causes to which the "elimination of the unfit" was still somehow subservient. The evidence for this comes in three forms: Wallace's interest in incipient structures, his continuing allegiance to the influence of "local causes," and his ongoing nod to "more recondite" forces and the Humboldt-related idea (earlier quoted) that a theory shouldn't be expected to explain everything.

3 Incipient Structures

In Wallace's time character variation was a commonly witnessed phenomenon, but just about nothing was known about the *origins* of that variation. Did a character come into being spontaneously, only to change over time in response to yet unknown forces? Wallace apparently thought so; at the least this model shielded him from thoughts of creationism or catastrophism. But as the years passed the "unknown forces" did not reveal themselves. This did not stop Wallace from continuing to theorize that particular characters of individual species suggested the influence of a "great natural law" in operation. For example, there were instances of what he termed "rudimentary organs," incipient structures on their way to recapitulating the plan of nature. In the Sarawak law essay he writes:

> Another important series of facts quite in accordance with, and even necessary deductions from, the law now developed, are those of *rudimentary organs*. That these really do exist, and in most cases have no special function in the animal œconomy, is admitted by the first authorities in comparative anatomy. The minute limbs hidden beneath the skin in many of the snake-like lizards, the anal hooks of the boa constrictor, the complete series of jointed finger-bones in the paddle of the Manatus and whale, are a few of the most familiar instances. In botany a similar class of facts has been long recognized . . . To every thoughtful naturalist the question must arise, What are these for? What have they to do with the great laws of creation? . . . If each species has been created independently, and without any necessary relations with pre-existing species, what do these rudiments, these apparent imperfections mean? There must be a cause for them; they must be the necessary results of some great natural law. Now, if, as it has been endeavoured to be shown, the great law which has regulated the peopling of the earth with animal and vegetable life is, that every change shall be gradual; that no new creature shall be formed widely differing from

> anything before existing; that in this, as in everything else in Nature, there shall be gradation and harmony, – then these rudimentary organs are necessary, and are an essential part of the system of Nature. Ere the higher Vertebrata were formed, for instance, many steps were required, and many organs had to undergo modifications from the rudimental condition in which only they had as yet existed. We still see remaining an antitypal sketch of a wing adapted for flight in the scaly flapper of the penguin, and limbs first concealed beneath the skin, and then weakly protruding from it, were the necessary gradations before others should be formed fully adapted for locomotion . . . (Wallace 1855: 195–196)

Obviously, Wallace felt that such characters anticipated future changes to be implemented on the basis of some "great law"; we now know most of them to be, evolutionarily speaking, remnant structures. Before long Wallace would adopt this correct view, but this did not stop him from continuing to look favorably on the "incipient structure" notion. In general, Wallace applied the term "incipient" to various immediately anticipatory events, for example the evolution of migration systems, morphological degeneration trends, the separation of varieties through the infertility of intercrossings, and the occasional appearance of a sport (e.g. specimens of fowls with horns). But he also continued to accept a "great law" approach to evolution in general, as summarized by DelMonte (2011):

> Wallace noted the problem of incipient evolutionary stages. He argued that incipient and intermediate stages might have little selective survival advantage, as with a partially developed wing; yet evolution progressed to new forms and greater complexity as if teleologically guided. Wallace thus predicted the problem of "irreducible complexity." A group composed of Paleo-anthropologists and Linguists similarly argued that the physical and cognitive articulations required for human speech are so sophisticated that it is difficult to imagine intermediary systems. They described as a Neo-Darwinian tautology the argument that if a human feature existed, then it must be adaptive, otherwise it would not have survived. This is a form of Panglossian, overly-optimistic, post-hoc reasoning . . .

Wallace's most remarkable views on incipient characters are connected to his thoughts on human evolution, and most particularly to the evolution of higher consciousness. In several writings he describes powers that "are so much in advance of their [i.e., savages] needs that they could not have been evolved by natural selection" (Wallace 1879:478). This is not a matter we can explore in great depth here, but it is important to understand that Wallace felt:

> The rapid progress of civilization under favourable conditions, would not be possible, were not the organ of the mind of man prepared in advance, fully developed as regards size, structure, and proportions, and only needing a few generations of use and habit to co-ordinate its complex functions. The naked and sensitive skin, by necessitating clothing and houses, would lead to the more rapid development of man's inventive and constructive faculties; and, by leading to a more refined feeling of personal modesty, may have influenced, to a considerable extent, his moral nature. The erect form of man, by freeing the hands from all locomotive uses, has been necessary for his intellectual advancement; and the extreme perfection of his hands, has alone rendered possible that excellence in all the arts of civilization which raises him so far above the savage, and is perhaps but the forerunner of a higher intellectual and moral advancement. The perfection of his vocal organs has first led to the formation of articulate speech, and then to the development of those exquisitely toned sounds, which are only appreciated by the higher races, and which are probably destined for more elevated uses and more refined enjoyment, in a higher condition than we have yet attained to. So, those faculties which enable us to transcend time and

> space, and to realize the wonderful conceptions of mathematics and philosophy, or which give us an intense yearning for abstract truth (all of which were occasionally manifested at such an early period of human history as to be far in advance of any of the few practical applications which have since grown out if them), are evidently essential to the perfect development of man as a spiritual being, but are utterly inconceivable as having been produced through the action of a law which looks only, and can look only, to the immediate material welfare of the individual or the race (Wallace 1870a: 358–360).

This became his explanation for the occasional emergence of mediumistic and other paranormal powers, which he viewed to be incipient abilities – that is, abilities that would become more common in the future as evolution's destiny played out.

4 More Recondite Forces

Two oft-expressed themes in Wallace's literary output are the closely related ideas that (1) a theory should not have to explain everything, and (2) there are always "more recondite" forces at work in nature. These philosophical points also seem indebted to Humboldt, as one of the earlier-quoted passages from *Cosmos* shows. Wallace used the "doesn't explain everything" caveat at least a dozen times in his writings, including this one from 1867:

> It is, therefore, no objection to a theory that it does not explain everything, but rather the contrary. A true theory will certainly enable us to understand many of the phenomena of life, but owing to our necessarily imperfect knowledge of past causes and events, there must always remain complicated knots that we cannot disentangle, and dark mysteries on which we can throw but a straggling ray of light (Wallace 1867a: 309).

Wallace found this idea useful in various contexts at various times, for example, in a defense of Darwinian logic (Wallace 1864:111), a discussion of the limits of applicability of natural selection (Wallace 1870a: 333), another such discussion (Wallace 1870b: 9), a defense of spiritualism (Wallace 1885a: 328), and a denial of the all-applicableness of the theory of evolution (Wallace 1908b: 1–2). The passage quoted above concerned a biogeographical matter.

A similar catholicity is to be found in his use of the term "recondite." This has two basic meanings according to the *OED*: a structure or habit removed or hidden from view (now rare), or, removed from ordinary apprehension, understanding, or knowledge. Wallace seems not to have applied the word in its now rare sense (though that usage often involved biological structures or habits). Of his 15 or so uses of the term, the four given below are typical:

This great principle [natural selection] gives us a clue which we can follow out in the study of many recondite phenomena, and leads us to seek a meaning and a purpose of some definite character in minutiæ which we should be otherwise almost sure to pass over as insignificant or unimportant (Wallace 1867b: 3).

> The flood of light that has been thrown on the obscurest and most recondite of the forces and forms of Nature by the researches of the last few years, has led many acute and speculative intellects to believe that the time has arrived when the hitherto insoluble problems of

> the origin of life and of mind may receive a possible and intelligible, if not a demonstrable, solution (Wallace 1869a: 105).
>
> . . . they [philosophers and men of science] have yet, for many years, refused to accept any facts or experiments which go to prove the existence of recondite powers in the human mind, or the action of minds not in a visible body (Wallace 1871: 29).
>
> Equally absurd is the allegation that some of the phenomena of Spiritualism "contradict the laws of nature," since there is no law of nature yet known to us but may be apparently contravened by the action of more recondite laws or forces (Wallace 1885b: 809).

It is apparent from both these samples and the ones given earlier that Wallace's opinion on the existence of "more recondite forces" changed very little over his career. A further indication of this is offered by his continuing allusion to possible extenuating circumstances related to "local causes."

5 Local Causes

Although Wallace immediately recognized the potential in the natural selection concept to explain a wide range of phenomena, he was not sure early on just how far it could be extended. As a result, when he was unable to come up with an explanation for a particular detail of adaptation, he fell into the habit of alluding to possible "unknown local causes" as being responsible. Interestingly, there is none of this in his writings before the advent of natural selection, and one cannot help but suspect that afterward he was "leaving the door open" for the development of further theory.

His earliest writings on this subject appeared in the famous monograph on Papilionidae, first delivered as a presentation before the Linnean Society in 1864. In this he reports:

> But even the conjectural explanation now given fails us in the other cases of local modification. Why the species of the western islands should be smaller than those further east, – why those of Amboyna should exceed in size those of Gilolo and New Guinea – why the tailed species of India should begin to lose that appendage in the islands, and retain no trace of it on the borders of the Pacific, are questions which we cannot at present attempt to answer. That they depend, however, on some general principle is certain, because analogous facts have been observed in other parts of the world (Wallace 1865: 19).

In 1869, in *The Malay Archipelago* he writes:

> Many groups of insects appear to be especially subject to local influences, their forms and colors changing with each change of conditions, or even with a change of locality where the conditions seem almost identical (Wallace 1869b: 284).

In 1876, in the first half of his lecture given as President of the Biology Section of the British Association for the Advancement of Science meeting, devoted entirely to the subject, he writes:

> I have argued, and still believe, that the need of protection is a far more efficient cause of variation of colour than is generally suspected; but there are evidently other causes at work, and one of these seems to be an influence depending strictly on locality, whose nature we

> cannot yet understand, but whose effects are everywhere to be seen when carefully searched for (Wallace 1876: 101–102).

The next year (1877), he observed:

> Another real, though as yet inexplicable cause of diversity of colour, is to be found in the influence of locality. It is observed that species of totally distinct groups are coloured alike in one district, while in another district the allied species all undergo the same change of colour . . . The most probable cause for these simultaneous variations would seem to be the presence of peculiar elements or chemical compounds in the soil, the water, or the atmosphere, or of special organic substances in the vegetation; and a wide field is thus offered for chemical investigation in connection with this interesting subject (Wallace 1877: 407).

A few years later, however, Wallace came upon a new theory of mimicry developed by the naturalist Fritz Müller (Wallace 1882), which quickly wiped away many of his remaining reservations about the ability of natural selection to explain certain details of adaptation. From this point onward he would have little to say about "unknown local causes."

6 Conclusion

In reviewing the general path that Wallace took to natural selection and beyond, one sees significant evidence of a Humboldtian influence. This gave him a strong initial philosophical position that could be linked to applied studies in the field, but it also caused him to misinterpret the relation of adaptations to evolutionary change for more than 10 years. And, even once he had come up with a more apt interpretation, he remained attached to the idea that environment might be secondarily influencing evolution in ways extending beyond natural selection. His very interest in biogeography, the most complex of all the sciences, attests to this, as do his positions on more restricted subjects. Take, for example, his greater attention than Darwin's to "environmental selection" forces such as temperature and precipitation, his theory that bird coloration was largely related to selection for drabness of females as a protective mechanism, and his attention to special protective coloration relationships, including mimicry (in which instance the mimicked species is, effectively, an element of the environment). So too, his attention to glacial theory, and even his late-career arguments as to what possibly could live where in the universe.

Another effect of the "more recondite forces" notion inherited from Humboldt was Wallace's continuing reluctance to observe a strict form of materialism, both before and after the Ternate essay. There is not a shred of evidence that as of 1858 Wallace felt that natural selection could explain the existence of humankind's "higher" mental faculties (Smith 2008), and one suspects that beyond the ethnological observations that helped lead him to his actual opinion, the "more recondite forces" stance was also a contributing influence. His adoption of spiritualism in 1866 was thus a function of these predispositions, and not the cause of them.

The Humboldt-Wallace relationship is one that deserves much more attention than it has so far received. That it has not is a function of simple oversight, the assumption that the main Humboldtian influence was of a "traveling naturalist inspiration" sort, and the only sporadic references Wallace made to Humboldt later in life. The last of these three reasons may trouble some observers, but it must be remembered that Humboldtian science was a philosophy and method, not a specific theory. Thus Wallace's direct references to Humboldt typically concerned facts the older naturalist collected, and not interpretations of process.

For Wallace, it can be seen, "incipience" was an ongoing "working hypothesis" about the nature of nature. He never was able to construct an appropriate model of final causes – that is to say, one from which actual science could emerge – but, after Humboldt, he remained unsure that all of the answers were already at hand.

References

Anonymous (1893) Woman and natural selection. Daily Chron (London) (9902):3

Bateson G (1972) Steps to an ecology of mind. Chandler Publishing Company, San Francisco

DelMonte MM (2011) Post-Darwinian psychology: does mind really matter? Int J Healing Caring 11. http://72.167.195.46. Accessed 21 Sept 2013

Marchant J (1916) Alfred Russel Wallace; letters and reminiscences. Cassell, London, Reprinted 1975 by Arno Press, New York

Meyen FJF (1846) Outlines of the geography of plants. Ray Society, London

Smith CH (1986) A contribution to the geographical interpretation of biological change. Acta Biotheor 35:229–278

Smith CH (2008) Wallace, spiritualism, and beyond: 'change', or 'no change'? In: Smith CH, Beccaloni G (eds) Natural selection and beyond: the intellectual legacy of Alfred Russel Wallace. Oxford University Press, Oxford, pp 391–423

Smith CH (2013) Alfred Russel Wallace's world of final causes. Theor Biosci 132:239–249

von Humboldt A (1846) Cosmos, vol 1. Longman, Brown, Green & Longmans, London

von Humboldt A, Bonpland AJA (1814) Personal narrative of travels. Longman, Hurst, Rees, Orme, and Brown, London

von Liebig J (1840) Organic chemistry in its application to agriculture and physiology. Taylor and Walton, London

Wallace AR (1845) Letter to H. W. Bates dated 28 December 1845. Wallace letters online. WCP346 (URL, accessed 21 Sept 2013. http://www.nhm.ac.uk/research-curation/scientific-resources/collections/library-collections/wallace-letters-online/346/346/T/details.html)

Wallace AR (1852) On the monkeys of the Amazon. Proc Zool Soc Lond 20:107–110

Wallace AR (1855) On the law which has regulated the introduction of new species. Ann Mag Nat Hist 16(2nd ser):184–196

Wallace AR (1856) On the habits of the orang-utan of Borneo. Ann Mag Nat Hist 18(2nd ser):26–32

Wallace AR (1857) On the natural history of the Aru Islands. Ann Mag Nat Hist 20(2nd ser):473–485

Wallace AR (1858) On the tendency of varieties to depart indefinitely from the original type. J Proc Linn Soc Zool 3:53–62

Wallace AR (1863) On the physical geography of the Malay Archipelago. J Roy Geogr Soc 33:217–234

Wallace AR (1864) Remarks on the habits, distribution, and affinities of the genus *Pitta*. Ibis 6:100–114
Wallace AR (1865) On the phenomena of variation and geographical distribution as illustrated by the Papilionidae of the Malayan region. Trans Linn Soc Lond 25:1–71
Wallace AR (1867a) On the Pieridæ of the Indian and Australian regions. Trans Entomol Soc Lond 4(3rd se):301–416
Wallace AR (1867b) Mimicry, and other protective resemblances among animals. Westminst Rev 32(n.s):1–43
Wallace AR (1869a) The origin of species controversy. Nature 1(105–107):132–133
Wallace AR (1869b) The Malay Archipelago: the land of the oran-utan and the bird of paradise, a narrative of travel with studies of man and nature. Macmillan and Co, London
Wallace AR (1870a) Contributions to the theory of natural selection. Macmillan and Co., London
Wallace AR (1870b) Man and natural selection. Nature 3:8–9
Wallace AR (1871) On the attitude of men of science towards the investigators of spiritualism. In: Tuttle H, Peebles JM (eds) The year-book of spiritualism for 1871. W. White & Company, Boston, pp 28–31
Wallace AR (1876) Address. Rep Br Assoc Adv Sci 46:100–119
Wallace AR (1877) The colours of animals and plants. Macmillan's Mag 36(384–408):464–471
Wallace AR (1879) Organisation and intelligence. Nature 19:477–480
Wallace AR (1882) Dr. Fritz Müller on some difficult cases of mimicry. Nature 26:86–87
Wallace AR (1885a) The "Journal of science" on spiritualism. Light (London) 5:327–328
Wallace AR (1885b) Modern spiritualism. Are its phenomena in harmony with science? Medium & Daybreak 16:809
Wallace AR (1890) Human selection. Fortnightly Rev 48:325–337
Wallace AR (1908a) The world of life: as visualised and interpreted by Darwinism. Fortnightly Rev 85:411–434
Wallace AR (1908b) Evolution and character. Fortnightly Rev 83:1–24
Wallace AR (1913) Social environment and moral progress. Cassell and Co., Ltd., London