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Jonathan Hodge

Centre for the History and Philosophy of Science, Department of Philosophy, University of Leeds, Leeds, LS2 9JT, UK;

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Jonathan Hodge

Centre for the History and Philosophy of Science, Department of Philosophy, University of Leeds, Leeds, LS2 9JT, UK; Email: m.j.s.hodge@leeds.ac.uk

Well before visiting the Galápagos Islands in September and October 1835, Darwin had embraced Lyell's teachings concerning the changes in land and sea and climate in past, present and future ages. He had also accepted Lyell's view that species extinctions and origins occur at all times. In February, 1835 he had broken with Lyell over the causes of some species extinctions. But he had had no reason to disagree with Lyell on species origins: any species is an independent creation with fixed characters, so there is no transmutation of species. The origin of any species occurs at just one place which is determined, and so explicable, by adaptational considerations alone. Darwin's Galápagos visit did not prompt any questioning of these Lyellian theses about species origins. However, less than a year later, in mid-1836, Darwin's discussions of the Galápagos mockingbirds, in his *Ornithological Notes*, show him to be now favoring transmutation, and to be finding support for this new view in the judgement that these birds differ varietally, but not specifically, on different islands. This new favoring of transmutation was not prompted by these reflections on these Galápagos facts, but by some other thoughts on some other facts. It is conjectured here that reflections, shortly before, on mainland South American bird biogeography, could well have occasioned this initial break with Lyell over species origins and prompted the shift to transmutationism. In early March 1837, several months after returning home to England, Darwin accepted John Gould's new judgements about his Galápagos bird specimens, and embraced two conclusions that he had never remotely contemplated before: namely, a general conclusion that many Galápagos landbird species, including the mockingbirds, were peculiar and so presumptively original to the archipelago while being very similar to other distinct species on the mainland; and a particular conclusion that the Galápagos mockingbirds comprised three distinct species, not mere varieties, peculiar to individual islands, and that they were distinct from all mainland mockingbird species. It was the novel general conclusion that convinced Darwin that his transmutationism was overwhelmingly vindicated. Within a few days, in his *Red Notebook,* he was integrating his disagreement with Lyell about species origins with his old disagreement over species extinctions. Within a few months, he was opening his *Notebook B* with a sketch of a comprehensive zoonomical system of theory conformed in its structure to the exposition given by Lyell of Lamarck's system.

1. Darwin in 1835: on the Extinctions and Origins of Species

By the time Darwin visited the Galápagos archipelago in September and October 1835, he had been committed for more than a year to Charles Lyell's views on the physical changes on the

earth's surface. There are aqueous and igneous causes for those changes in land and sea and climate taking place throughout the past, ever since the oldest known fossil-bearing rocks were laid down, and these causes continue in action at present and on into the future with the same kinds and sizes of effects. As for the coming and going of species, Lyell held, as no other geologist did, that the extinctions of species went on at all times in the past since the age of those strata, are going on now and on into times to come; and likewise with species origins.

The Darwin who was visiting the Galápagos had had no reason to disagree with these Lyellian teachings about species extinctions and origins. However, in February 1835, in his first overt break with Lyell concerning the living world, he had disagreed with his mentor about the causes of species extinctions. Lyell held that extinctions were caused by competitive upsets or defeating invasions brought on by changes in climatic and other local circumstances. Darwin, disagreeing, adopted a theory respectfully discussed but rejected by Lyell: the theory that species die because like any individual higher animal, and — as it was usually thought then — like a graft succession of apple trees, they have an intrinsically limited lifetime, an inherent mortality. So, on Darwin's new view — only given up entirely on reading Malthus in Autumn 1838 — failures to survive upsets or invasions may end some species lives before their limited lifetime has elapsed; but other species, in the absence of such circumstantial changes, have died from old age.[1]

This disagreement with Lyell over the causes of species extinctions obviously required no disagreement over species origins; and, indeed, on the origins of species, Darwin will make no break with Lyell until well after the Galápagos visit. Lyell did not claim to know what would be observed if naturalists were ever fortunate enough to witness a species originating. He did hold, however, that species are fixed in their characters, so that even in changing conditions in the long run they only diversify adaptively into intraspecific local varieties, never varying enough to give rise to new distinct species. In his terms, he opposed the transmutation of species. Accordingly, he opposed too what he called Lamarck's system, which he engaged as the most fully articulated system of transmutationist theorising. As an explicit alternative to Lamarck, Lyell took species to be special creations; each was a creation independent of any prior species. As a hypothesis, he assumed, further, that each species creation takes place at a single location, that there is a first pair of individuals or a lone hermaphrodite, and that the time and place of origin is providentially determined entirely adaptationally. The timing and placing are therefore explicable solely by adaptive considerations. The species originating at any location at any moment is the species best suited to the conditions there: physical conditions of soil, climate and so on, and other conditions arising from the plant and animal life already there. Lyell draws the most general biogeographical corollaries from this hypothesis: very different conditions in two regions will have called for the origins of very unlike species; while, if closely alike species, congeneric species, have originated in two areas that is because similar structure and functions have been required by similar conditions in those two places. The similarity among the species is due to, and explicable by, similarity in conditions where they originate.[2]

So, in sum, Lyell explicitly upheld five theses about any species origins: (i) independent creation (ii) fixity of character (iii) single original location (iv) one or two first individuals, and (v) adaptational determination of time and place. It is worth distinguishing these five theses because we can then understand how, in initially breaking with Lyell over the fifth, Darwin will be breaking with him too over all the others except the single original location thesis. Looking ahead, we shall see Darwin, in March 1837, five months after returning to England, recording in his *Red Notebook*, the earliest surviving theoretical reflections that show him to have disagreed decisively with Lyell in this way over the origins of species; and we shall see him integrating this break with the earlier one over the causes of species extinctions.

The question has to be posed then: how, when, and why had he first come to this change of mind over species origins? Was it very shortly before those notebook entries, and so well after his return to England, or was it many months earlier when still on the voyage, perhaps even as early as his visit to the Galápagos in 1835, and because of what he was observing, collecting and conjecturing there?

I shall be arguing that, on the most likely interpretations of all the documentary evidence that we have for his intellectual life over these two years, the change came neither when he was at the archipelago nor after his return to England. Let me emphasise right away that I shall argue that new reflections on the Galápagos bird species — reflections arising from John Gould's novel conclusions early in March 1837, about Darwin's Galápagos bird specimens — were overwhelmingly decisive for Darwin. For those reflections were decisive in convincing him that he was now unexpectedly and conclusively vindicated in his earlier tentative disagreement with Lyell's views on species origins, so that the time had now also come to act on that disagreement confidently and comprehensively. However, I shall be conjecturing that those March 1837 reflections — following the consultations with Gould — could be so decisive not because they were prompting that break for the first time; but, rather, because Darwin had already made that break, in mid-1836, a few months before the voyage's end in October, 1836; and I shall be conjecturing that at that time it was not reflections on any Galápagos observations or collections that were decisive in initiating this first movement away from his mentor's teachings on species origins.[3]

I should emphasise that the reconstruction given here of Darwin's changing thoughts over these two years is often complicated and sometimes conjectural. I shall ague that this is inevitable because no straightforward story sticking close to the texts is textually defensible. As happens often in biography, the textual evidence requires complications and conjectures if credible, coherent and encompassing interpretations are being sought. I should emphasise too, however, that in this Darwin case at least, the complications and conjectures are such that when we have worked our way through them they can be given succinct if not simple summaries; and that such succinctness is on offer at this paper's close; and I may note that it may be helpful for readers to allow themselves to go there — and to the paper's Abstract — right now, to get some sense of what conceptual and narrative issues have to be engaged next.

2. Darwin at the Galápagos and After

When at the Galápagos and shortly after, Darwin made extensive entries about the animals there in his *Zoology Notes*; and made comments too at that time in his *Field Notebooks*, in his correspondence and in his *Diary*. What none of these texts even hint at is that Darwin is being prompted to have any new thoughts about species origins by anything he has observed or been told. Hindsight may tempt us to read into some textual moments signs of some rethinking, but there is no ground for giving in to those temptations. To be sure, Darwin says of the lizards of the genus *Amblyrhyncus*: "I can not help suspecting that this genus, the species of which are so well adapted to their respective localities, is peculiar to this group of Isds". However, there is nothing in such a judgement that anyone who was in agreement with Lyell's views, as Darwin then was, would take as calling for any rethinking. A note records that Nicholas Lawson, the English Governor there, claimed to be able to tell with certainty from which island any tortoise had been brought. Again, on the mockingbirds, he writes: "This birds which is so closely allied to the Thenca of Chili (Callandra of B.Ayres) is singular from existing as varieties or distinct species in the different Isds." Noting that he has four specimens from four islands, he continues: "These will be found to be 2 or 3 varieties. Each variety is constant in its own Island … a parallel fact to the one mentioned

about the tortoises." But, once more, there is no sign here that these judgements, whether firm, tentative or vacillating, are being seen by Darwin as raising any issues bearing on any conventional or controversial positions on the origins of species.[4]

Quite generally, Darwin noted in his *Diary* when at the Galápagos: "It will be very interesting to find out from future comparison to what district or 'centre of creation' the organised beings of this archipelago must be attached." In his *Zoology Notes*, he is soon decided about the birds: "The Ornithology is manifestly American." He is unsure about the plants, noting in his Galápagos field notebook: "I certainly recognise S. America in ornithology, would a botanist?" Writing to John Henslow a few months later, he says that he will be curious to learn "whether the Flora belongs to America, or is peculiar." The contrast invoked in all such reflections and queries is the one familiar from the biogeography of the day, including Lyell's chapters. Animal or plant species peculiar to the Galápagos are those species thought to be living only on this land and so those species are presumed to have originated there. Darwin is judging that, unlike the lizards, the Galápagos birds include no peculiar species. The land birds evidently belong with mainland America as a center of species creations, as a site, that is, of species origins and dispersions; that is where these species are presumed to have originated, and so it is from there that individuals of these species are presumed to have migrated to the islands. For the rest of the voyage, Darwin will continue to presume that none of the Galápagos bird species is peculiar to the archipelago, and that all have originated elsewhere — in the case of the landbirds most likely in the Americas — before some individuals migrated to the archipelago. For the rest of the voyage, the presumptively-distant origins, American or otherwise, of the Galápagos bird species will have no bearing on any agreements or disagreements about species origins that Darwin is having with Lyell or any other mentor. The origin of the mockingbird species is no exception. Darwin presumes that this species originated on the American mainland. Only its Galápagos varieties will be judged to have originated on the islands; and it is only these island varieties that will be seen to have a bearing on species origins issues; and not until mid-1836, just a few months before the voyage's end in October 1836. The other Galápagos bird species will have none until early 1837, and so several months after he returns to England.[5]

Obviously, Darwin found the Galápagos archipelago instructive, dramatic and intriguing for all sorts of reasons: geological, botanical, zoological and so on. But there is just no call to interpret any of his responses to what he saw, heard about or collected on the islands when he was there as including, involving or implying fresh thoughts about species origins. Nor, as we move on through the next months through to mid-1836, is there any reason to think that the Galápagos — or any other region Darwin has visited before or after his time there — has occasioned such thoughts. For example, he certainly found the animals and plants of Australia and New Zealand curious in many ways; but there is no reason to interpret his reflections on them as signalling any new views about the origins of species. We may turn next then to famous entries made by Darwin in mid-1836, probably in June or July and so still a few months from landing back in England. They are entries within the pages he devotes to the birds of the Galápagos in his *Ornithological Notes*. These notes are not merely written out carefully; they are plainly composed by an author who knows where he is going, in moving from the opening of any line of reflection through its subsequent steps and on to its final conclusions.

The broad-ranging comments he makes about the islands and their animals and plants, in opening the section on the Galápagos birds, show no signs that he is linking any general judgements about this land and its inhabitants to any theoretical stances on species origins. Nor do the special remarks about the finches lead to any links. In numbers of species and individuals, they are the most abundant bird family, he says; but amongst these species there is, for him, "an inexplicable

confusion." There seems to be a gradation in the form of their bills; and he cannot distinguish the species by their habits, as they are all similar and feed together in large irregular flocks. By contrast, the particular notes devoted to the mockingbirds do end by making just such a link. Before the sentences leading to the making of that link, Darwin opens by reaffirming that these mockingbirds are very similar in appearance to the Chilean Thenca and Callandra of La Plata, and that in their habits he cannot "point out a single difference", although he imagined that their cry was rather different from the Chilean Thenca. He notes that he has specimens from the four largest islands, and that those from Chatham and Albermarle "appear to be the same; but the other two are different;" and he notes too: "In each Isld. Each kind is *exclusively* found; habits of all are indistinguishable." Then comes that linking:

> When I recollect, the fact that [from] the form of the body, shape of scales & general size, the Spaniards can at once pronounce, from which Island any Tortoise may have been brought. When I see these Islands in sight of each other, & [but *del*.] possessed of but a scanty stock of animals, tenanted by these birds, but slightly differing in structure & filling the same place in Nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware, is the constant asserted difference — between the wolf-like Fox of East &West Falkland Islds. — If there is the slightest foundation for these remarks the zoology of Archipelagoes — will be well worth examining; for such facts [would *inserted*] undermine the stability of Species.[6]

3. Mockingbird Varieties and Unstable Species

These cryptic sentences have attracted much attention over the years; and understandably so, as they are the only ones known from Darwin's voyage years where any explicit engagement is made with the issue of species transmutations. Rather surprisingly, perhaps, no one has analysed these sentences at length, phrase by phrase. I will be offering such an analysis shortly. However, before getting to the details it is worth standing back, and looking at the passage as someone might who has never met it before, someone who is considering the apparent drift of the passage as a whole. I would think that such a person might see three movements of thought here: first, a move from the particular case of the mockingbirds on separate islands to a generalisation about archipelagos having distinct varieties of species on separate islands; second, a move to the interest of archipelago zoology, and, third, a move to the undermining of the stability of species. What is more such a person would, I think, read these three moves as positive moves, that is as moves made by an author who is welcoming not resisting what comes at all the steps along the way: the case, the generalisation and its two corollaries, the interest in archipelagos and the instability of species. These are all welcome prospects. Indeed, given that this whole passage is evidently written by someone who has the ending in mind throughout, it would seem only right to suppose that all the moves made were designed to lead to the last as the final outcome. In sum, the Darwin who wrote this is here starting the work of making the generalisation well-founded because, if he can do so, he gets something from it that he wants — the undermining of species stability. What we shall see next is that a close scrutiny of the way the passage goes, phrase by phrase, confirms that this overall impression is correct. The passage is written by a Darwin who is glad to be marshalling this generalisation because he sees it as welcome support for unstable species.

In tracking what follows, it is crucial is to put out of mind any knowledge one may have about what is going to happen later, when Darwin has those new thoughts about the Galápagos birds following his new reflections on John Gould's new judgements about them in March 1837. For we need to avoid bringing to the reading of this passage preconceptions about Darwin's thinking that

are only appropriate to understanding how he is later going to be reasoning in March 1837. We need, rather, interpretative presuppositions appropriate to understanding him around June or July 1836.

More precisely, before undertaking a detailed exegesis, we should identify one particular mistaken preconception. In March 1837, it will be as judged by Gould to be not mere varieties but distinct species that Darwin will take the mockingbirds to be impressive evidence for transmutation. So, it is tempting to suppose that in mid-1836 it must also have been only as judged to be species not mere varieties that they could be thought by Darwin to support transmutation. However, we shall see shortly that, in mid-1836, it is exactly the other way round. Given the very different assumptions Darwin was then making about the islands and about these birds, it was only as varieties rather than species that they could have any bearing on the question of transmutation. At this time, if taken to be species they would have had, for Darwin, no bearing at all, much less any positive bearing, on the transmutation question. Why? Because in mid-1836 he is assuming that if they are species then they would have arrived on the Galápagos as three distinct migrant species that had originated on the continent of South America, perhaps on the nearest part and so on land he had not visited, the *Beagle* having sailed to the Galápagos by a north-westerly not a due westerly route. The contrast with March 1837 is then crucial. For it is from Gould that he will then learn what he had had previously no inkling of: namely, not only that they are species rather than mere varieties, but also that they are species not found on the continent and so are species that have presumably originated not on the continent but on the Galápagos .

We will be getting, in due course, to Darwin's new reflections in March 1837 on those new judgements by Gould. All one needs to grasp now is that Darwin's whole line of reasoning — in the mid-1836 mockingbird passage — is designed to decide between only two options; and that neither option involves any mockingbird species rather than varieties originating on the Galápagos. No such option is even in play implicitly. The reasoning only works as it does because that option is not in play. There is a varieties option and there is a species option, yes, but there is no option involving species that have originated on the islands. The species option assumes that any species now living on the islands would have originated on the mainland.

Consider next then the first conclusion Darwin reaches: that the mockingbirds differ only as varieties on different islands.A crucial point is that his use of the word "suspect" elsewhere shows that his use of that word here carries no implication of fear or distrust [7]. So, the conclusion may be rendered as saying that he must tentatively believe that the birds on the different islands are varieties. The tacit contrast is obviously with their being believed to be species.

He marshals five considerations as supporting this mockingbird varieties conclusion: 1. the tortoise report, 2. the closeness of the islands, 3. their scanty stock of mammals — in his voyage notebooks Darwin routinely uses this word "animals" to mean mammals, 4. the slightness of the mockingbird differences in structures, and 5. their filling the same place in the economy of nature — there are no differences, that is, in how they make a living, in where and what they eat and so on.

Let us take these considerations in turn. Strictly, the tortoise report implies one island only for each variety, and not one variety only for each island. But Darwin assumes both implications are true because he is asserting the parallel between the tortoises and the mockingbirds, and with the birds each kind is found exclusively on any one island even, as he notes, if one kind may be found on more than one island. These picky points are pertinent because, if two distinct kinds were to be found living on one island, their being distinct would suggest strongly that they were not interbreeding, which in turn would be grounds for judging them to be distinct species. So, in sum, the tortoise report supports the mockingbird varieties conclusion because of this parallel, with its

implication that there are no cases where tortoises or mockingbirds have more than one distinct kind on one island with no interbreeding.

The trick to understanding 2 and 3 is to see how they are complementary. The islands being so close as to be visible from one another is evidence that it is easy for plants and animals to migrate from one to another by flying, floating or whatever. By contrast, the scant stocking of the islands by land mammals shows how difficult it has long been for organisms of most kinds to migrate to the islands from the nearest mainland. Land mammals, as Lyell had emphasised and as Darwin had reflected before, are — precisely because of their poor powers of migration across ocean waters — good indicators of what changes in land and sea have or have not been going on over the eons in any region. For Darwin here, the scarcity of land mammals on the Galápagos shows not just the difficulty arising from the hundreds of miles of ocean now, but the unlikelihood of any complete or partial land bridge in the past. So, in sum, island to island migrations have been easy and frequent, mainland to island migrations very difficult and infrequent. Finally, 4 and 5 together emphasise that the structural differences, that allow Darwin to distinguish the kinds on separate islands, are not matched by any functional differences as they would be if these were distinct species.

As for the Falkland fox case, it is similar to the tortoise and mockingbird cases in that here too is an instance of this general fact: intra-specific, inter-varietal, intra-archipelago, inter-island differences. And that general fact is the decisive one for Darwin. Watch next to see how Darwin's argument for its instantiation by the mockingbirds invokes a contrast between two migration scenarios. What Darwin is arguing for is this: one migration from mainland to archipelago, followed by two or more migrations since from island to island with subsequent varietal divergences between mockingbirds on separate islands. What Darwin is arguing against is, therefore, a possible alternative migration scenario that he thinks is far less likely: three migrations of three species from the mainland with these three species landing up with only one species on any one island. The whole argument in favor of the varieties conclusion only works because the alternative, distinct species conclusion, requires the much less probable migration scenario. Notice, too, that the reasoning simply does not include, even as a possibility to be argued against, another, third migration scenario: namely, one mainland species migration to the archipelago with two or more island to island migrations followed by specific divergences on separate islands. This scenario is not in play, even tacitly, because Darwin is not even countenancing the possibility that there is any mockingbird species peculiar to the archipelago and presumed to have originated there. There is the variety judgement with its requisite migration scenario; and there is the species judgement with its very different migration scenario; and, because those are the only two options in the argument, any improbability established for the second option is so much probability conferred on the first. Some of the greater credibility of the variety judgement is independent of migration scenario considerations, but some is directly so dependent; and both lots of considerations favor the first judgement over the only alternative. It is on this view that there are only these two alternatives, and on this view that both lots of considerations must be figured in, and that the reasoning of the whole argument is grounded.

Turn now to the closing words. The inserted "would" does not complicate matters exegetically: it is simply required grammatically by the conditional, the "if". So, the last sentence is asserting that (if well- founded) the archipelago generalisation — about inter-island, inter-varietal differences — undermines species stability. Now, the parenthetic point about well-foundedness may be taken as given from here on, for obviously no ill-founded or unfounded generalisation could undermine anything of theoretical importance. As has been urged earlier, in this complex conditional sentence, if the generalisation has indeed any prospect of being well-founded, then archipelago zoology promises to be very interesting. So, the argumentational rather than presentational order is

from the generalisation to the species instability prospect, which prospect duly makes archipelago zoology of great interest.

Two questions now cry out for attention if this reading of this passage is even roughly right. Why did Darwin think the archipelago generalisation makes for species instability? And was he hopeful or fearful about this prospect? Take the second question, the attitude question, first.We have seen already that the structuring of the whole passage indicates a positive attitude. Darwin seems to be doing what comes before the punch line because he is wanting to secure that outcome rather than wanting to discredit it. Equally, the wording signals positive attitudes along the way: the conjunction of "slightest foundation" with "well worth" is surely hard to square with any suggestion that Darwin is stringing all these reasonings together because he wants to alert himself to a prospective path leading to an unwelcome destination. Let us stay, then, with the positive reading of this passage.

4 A Possible Inaugural Rationale for Favoring Species Transmutations

That other question can now be postponed no longer. If Darwin did think the archipelago generalisation — about inter-varietal, inter-island differences — undermined species stability, then why did he think this? The first and obvious point to make emphatically is that he would not have thought that this generalisation was inexplicable by anyone holding Lyell's views. This general fact was manifestly consistent with the view that species are fixed and vary only limitedly so as to diversify varietally but not specifically. Equally, then, he would not have been thinking such a generalisation required invoking any species transmutations for its explanation; these were not cases of specific transmutations, so they did not require explaining as the results of species transmutations. So, if they were not seen by Darwin as cases of transmutation, nor seen as requiring transmutations for their explanation, how could he think that they could contribute in any way to undermining species stability? A partial clue is in Lyell, where he reports Lamarck as supporting his case against the stability of species (Lyell uses this phrase) by citing the tendency of species to diversify into varieties on migrating to new areas with different conditions. But, as we have been insisting all along and as Darwin was fully aware, this tendency in species is one that Lyell's special-creation-of-fixed-species theses could easily accomodate. However, consider the mockingbirds as an instance of the archipelago generalisation: the varietal divergences have occurred following island to island migration; and, as Darwin plainly judged at this time, the islands did not differ in their conditions. So, I conjecture that this generalisation was thought by Darwin to bear on transmutation because adaptations to different conditions were not involved in these varietal divergences. The species had diversified varietally solely because of inter-island isolation. Why, then, was the generalisation decisive in making archipelago zoology bear positively, in Darwin's thinking, on the prospect of undermining species stability? Perhaps because, as a transmutationist, he could cite the generalisation as evidence that mere isolation, independent of any differences in conditions, suffices to cause varietal divergences that a transmutationist can interpret as the initial stages in species divergences. This conjecture about Darwin's thinking at this time may be supported by noting how he insists that, although distinguishably differing in structural characters, the mockingbird varieties are functionally the same, suggesting that the varieties are not adaptations to different conditions, but consequences of isolation alone as such, so suggesting that species may be made mutable by causes not taken fully into account by views such as Lyell's.[8]

We now can see where we have to go next. Darwin was favoring transmutation when in mid-1836 he writes this passage; but — as already emphasised — he would not have thought that these facts, these cases, or indeed the archipelago generalisation itself, required anyone, himself included, to give up special creations of fixed species; because these cases involve only inter-varietal not

inter-specific divergences, whether following mainland to island or island to island migrations. So, on the most probable reading of the famous passage from mid-1836, he must be read as someone who was not being moved to transmutation by reflecting on these archipelago facts, but as someone who was already favoring transmutation on account of other reflections on other facts; other facts which, unlike these, he would have taken to require transmutation for their explanation, other facts that he was judging to be not readily reconciled with Lyell's theses, other facts that he thought were most readily explicable as resulting from completed species transmutations. Now, this much is defensible on textual and contextual evidence alone. But plainly to accept this much is to face a further question, one which is beyond resolution on any direct documentary evidence.What other reflections on what other facts had prompted this inaugural favoring of species transmutations?

Faced with this question, we could go in at least three directions: (a) insist that this question is so difficult to answer that we should back up, reinterpret everything set out above, and find some other interpretative journey that avoids ever arriving at this question; (b) accept that we are faced with this question, but must reckon it unanswerable, and just proceed on to more answerable questions about what happens next to Darwin, especially when he gets back to England; or (c), finally, have a go at guessing, hoping though not expecting that one line of guessing may look more likely than others. Now, I know of no principles of proper procedure in doing the history of science that can dictate a choice among these three options. My training, my role models and my prejudices prompt a preference for the third, but my experience tells me that many other people are not like that. Readers who do not share my view in this matter may wish to skip the next few paragraphs and rejoin the story in the next section.

We want a guess that is guided by at least four desiderata: first, our guess should assume that Darwin had only recently — that is just before the mockingbird passage of mid-1836 — become inclined toward species transmutations for the first time; for, if he had long been favoring that view, we would probably find documentary signs of this inclination; second, our guess should take seriously the precise formulation of Lyell's alternative to species origins in species transmutations, and not represent Darwin as merely moving away from any old doctrine that we might call creationism; third, we need to find factual generalisations that Darwin is confident of at this time, in mid-1836, and which he will later argue are best explained by transmutation and difficult to reconcile with Lyellian special creations; fourth, we need a guess that coheres well with any reconstruction that we are going to give of what happens later, especially in March 1837, but not a guess that reads back uncritically issues that Darwin will only engage after his return to England.

On the guess that I favor, it is well worth looking at what Darwin has just been attending to, in mid-1836, in his *Ornithological Notes* almost immediately before the pages on the Galápagos birds. For he has just been discussing various genera of birds observed and collected much earlier on the voyage when he was on the mainland of southern South America. One genus, *Myothera* (later named *Pteroptochos* by Gould) can illustrate especially clearly what considerations about species origins may, just possibly, have been concerning Darwin at this time. This genus, Darwin emphasises, is peculiar to the most southern part of this continent, but within this broad area are found six distinct species often restricted to particular regions with very different conditions: arid or rainy or temperate. That much is explicitly noted in detail in his notes.[9] My guess is, then, that he could well have been interpreting these facts as anomalous for Lyell's view of species origins. For, at this time, Darwin's understanding of the history of that young land, fairly recently elevated above the sea, would have supported him in thinking that these species had originated pretty much where they now live, and that the conditions were then pretty much as they are now. So, on such a geologico-geographical interpretation, they could have been for Darwin cases of very similar species that have originated within one large area but in places within that area with very different

conditions. Their close similarities, close enough to make them congeneric species, cannot therefore be explained as required adaptationally by similar conditions because the conditions were not similar but different.

We need next to guess at what Darwin would have reflected if he had faced such a lack of explanatory fit between such facts and Lyell's theses about species origins. Well, let us recall how, in later years he would argue that, in any such cases, an explanation invoking common descent from a common ancestral species for all the species of the genus is a better explanation than any explanation ascribing the common characters to common adaptations to common conditions, because there were no such common conditions. This invocation of common ancestry for distinct congeneric species obviously requires inter-specific divergences from the one ancestral species, and divergences among the distinct descendent species, and so it requires inter-specific transmutations. This commitment to intra-generic, inter-specific transmutations must, therefore, replace any commitment to fixed, specially, separately, independently, created species. Indeed, after this shift to transmutation, all that would be left of Lyell's five theses would be the hypothesis of a single place of origin for each species.

It is worth dwelling on the reasoning posited by this guess about Darwin's first move to transmutations. This guess does not have him somehow witnessing new species arising from older ones. No, it has him moving to common intra-generic ancestry to explain facts that conflict with any common adaptation explanation for similarities among some congeneric species supposed to be special creations; and, it has him moving to transmutations, therefore, not initially because he wants divergences as causes of some otherwise-inexplicable inter-specific differences, but because he wants common ancestries as causes of some otherwise-inexplicable inter-specific resemblances. That one shift on that one issue brings with it an abandoning of all of Lyell's theses except one. Note too how the shift would have been understood by Darwin himself. As Lyell's discussion of Lamarck emphasised, the transmutationist position could be construed as taking the view Lyell held — of common descent within any species, and hence common ancestry as the cause of similarities among the varieties of that species — and doing what Lyell would not do: namely extrapolating that common ancestry, and so too that explanation for similarities among the descendents, to any genus comprising several similar species. For Lyell, conspecific varieties owe their common characters to their common ancestry, and owe their distinguishing characters to subsequent divergences. The transmutationist goes on to suppose that with more diversification there arise interspecific differences, and so a genus of distinct species owing their common characters to their common ancestry. And, again, as Lyell emphasised, this transmutationist need not stop extrapolating there, but can go on to wider and wider extrapolations, to families, classes and whole kingdoms, crediting shared characters to shared ancestry and peculiar ones to divergent descents — just as Lyell does intraspecifically and intervarietally, but only so.

These points all bear directly on what further guesses we should be making about the relations between two clusters of issues engaged by Darwin at this time, if our guessing is roughly right so far. If it was the *Myothera* facts, or others like them, that were the first to be explained by him as cases of completed species transmutations, then we may say that this shift to this explanation was Darwin's initial and primary rationale for first favoring transmutation as such. What then of the intervarietal divergences among the Galápagos mockingbirds? These would have been entering into his new transmutationist thinking in quite another way; not evidencing transmutation as such because not requiring explanation as cases of completed transmutations. No, they are cases of incipient species transmutations that have only gone as far as intervarietal divergence. And so it is not this intervarietal divergence by itself that is decisive; it is the circumstances of it: on islands that are the same in conditions and among varieties filling the same places in the economy of

nature, suggesting that mere isolation itself is making these species unstable. At this stage then, if all this guessing is not hopelessly wrong, the mainland bird genera and the archipelago bird varieties are making quite different contributions to Darwin's new transmutationist thinking about species origins. Moreover, on this guess, the mainland reflections, about such genera as *Myothera,* have priority; while the island reflections are supplementary in bearing, not on the primary issue of the explanatory need for transmutation itself, but on the secondary issue about what circumstances may be effective in starting transmutations. We need, then, to distinguish from now on between that earliest, primary rationale and this subsequent, secondary, supplementary one.

Mid-1836 to March 1837 is well over half a year, and it may seem odd to skim over that whole period here. But we do so for good reason: although studied closely, the documents from those months have never been found to include any indications of any further developments in Darwin's views on species origins. The supposition, the guess, made here is, therefore, that Darwin continued inclining toward transmutation and continued his commitment to the primary and secondary rationales for transmutation without any experiences or speculations prompting him to develop that thinking beyond where he had gone with it in mid-1836. One further guess would naturally credit him with holding these transmutationist views only tentatively, very mindful as to how controversial they would be and so how fitting it could be to put off exploring all their implications until other, more pressing duties were discharged both while at sea and back in England. In any case, we here must proceed on the assumption that in early 1837 — when he begins learning of Gould's judgements on his specimens — his thinking was still pretty much as set out in our distinguishing of the primary and the secondary rationales for his mid-1836 transmutationist views.

5. The Gould Consultations and After

This distinction between the two rationales can throw light on why Darwin was so massively impressed by the new judgements that Gould would make about the Galápagos bird specimens. Those judgements transformed the Galápagos in two ways. First, they changed the Galápagos islands from being the site for a secondary, supplementary rationale for transmutationism, to becoming a stellar instance of the primary rationale: distinct species originating in locations with very different conditions, the arid islands and the lush nearest mainland. Second, they enhanced the secondary rationale by raising the mockingbirds from varieties to species, species moreover original to their islands, not to the mainland where, Gould insisted, those species were unknown.

There seems to have been a crucial meeting with Gould at the Zoological Society within three or four days of Darwin moving to live in London on March 6.[10] On a single sheet of paper, Darwin noted down what were for him the decisive details about the landbird species collected from the Galápagos. The principal exercise was simple enough: to list all the landbirds in no special order, to note if they were peculiar to the archipelago, and to note if they belonged to genera peculiar to the Americas. The results from the exercise would be summed up by Darwin within a month or two when composing the Galápagos chapter of his *Journal of Researches* published two years later. After discounting various exceptional and uncertain cases, Darwin had some ten species, including a buzzard species, the three mockingbird species, a species of dove, a species of swallow and four other species supporting the general claim that, among the landbirds, many were species peculiar to the archipelago but exclusively American in general structure, habits, coloring and cries.[11]

We can see now why we have to distinguish in this way between two main conclusions that Gould's judgements enabled Darwin to reach about the Galápagos bird specimens: a general conclusion covering several species, including the mockingbirds, and a particular judgement about the

mockingbirds alone. The general conclusion was the influential one concerning Darwin's transmutationist convictions at this time. For Darwin, this generalisation suggested a completely novel geologico-geographical reflection: many landbird species had originated on those young arid volcanic islands and yet were very similar to species that had already originated in very different conditions on the nearest older continental land, rather than resembling the species that had originated on other arid, volcanic oceanic islands elsewhere in the world. These similarities are then explicable not as common adaptations but rather as due to common ancestries. This reflection was exactly in accord with what we have distinguished here as the primary rationale for Darwin's transmutationism. Note, too, that it is Darwin's engagement with Lyell's geologico-geographical theorising that takes him far beyond where Gould's judgements went in themselves; and that the influence on Darwin of this general conclusion about the Galápagos landbirds does not depend on that land being so many islands. This generalisation would have been no less massively influential for Darwin's transmutationist convictions if that land had comprised only a single oceanic island.

Consider next what is now new in Darwin's special reflections on the mockingbirds. Their specific divergences have arisen not just between Galápagos descendents and mainland ancestors, but also following later migrations from one island to another. Here, with the mockingbirds, it is crucial that the Galápagos land is a cluster of islands. Notice, however, that this special conclusion about these birds bears on the secondary rationale — isolation as conducive to transmutations even with no differences in conditions — not on the primary rationale. This point is well worth clarifying because one often reads biographers of Darwin, knowledgeable specialists some of them, saying in effect that it was above all, or even solely, the Galápagos mockingbirds, just these three species, that somehow sufficed to move Darwin, as the usual phrasing has it, from creation to evolution. Any such claim is narratively misleading because analytically too indiscriminate. Along with other species, the mockingbirds — on the mainland and the islands — came within the general conclusion bearing on the primary rationale. On their own, the three archipelago species also bore on the secondary rationale. The primary rationale concerned common ancestry as causing resemblances among species originating in different — mainland and island — conditions; the particular conclusion about those three island mockingbird species concerned isolation as causing differences between species originating on islands with apparently the same conditions. So, the mockingbirds were special in uniquely contributing to both rationales; but, they contributed most decisively, along with other species, through the primary rationale.

In the early months of 1837, Darwin was reflecting also on new judgements made by Richard Owen about his South American fossil mammal specimens. These new judgements confirmed for Darwin a generalisation he had long embraced and which he knew Lyell had too: the law of the succession of types, the law that the extinct species found as fossils in any area of land today are often of the same genera or families as the extant species living there now. In itself that generalisation would not have led Darwin to any disagreements with Lyell, nor therefore led him to incline to transmutation for the very first time. However, one new example of it does feature in his *Red Notebook* theorising in early March 1837. Bones Darwin had thought might be remains of an extinct mastodon species were interpreted very differently by Owen, so that Darwin was soon thinking of this species as a large extinct llama species like those species of smaller llamas living in South America. He went on to draw a parallel, between the relationship between these species over time, and the spatial succession shown by two living species of *Rhea* (or ostrich) species, the larger northern species and a smaller congener to the south; and he speculated that in such cases, where the two species overlapped in range, the transmutation would have been saltationary not gradual.[12]

At the same time, in this notebook, Darwin draws another parallel, between what determines

the timing of species extinctions and what determines the placing of species origins. Some groups of species, among the mammals especially, have not had any of their species originate in some areas where they flourish once they get there with man's aid. This flourishing shows that those original absences cannot be explained as due to lack of adaptation of that group to the conditions there. Hence, for Darwin, the parallel with species that have died from old age in unchanging conditions, and not because they failed to adapt to any changes in conditions. The implicit reasons for this parallel were assumptions about limited ancestral inheritances. The regional absences are due to all the species in the group descending from one ancestral species none of whose descendents has succeeded, before man helped, in migrating to those regions. The origins of species of that group are regionally limited because of ancestral and migrationary limitations, not because of adaptive unsuitability. Likewise with some species extinctions; these are due to the propagation, within any one species, of a durationally limited species life from the earliest to all later members, with the species extinction eventually coming not from adaptive failure but from the ending of that transmitted, limited duration.[13]

It was Lyell who had taught Darwin to consider parallels between temporal, geological successions and spatial, geographical ones. But here, obviously, Darwin is disagreeing with Lyell over the assumptions to be brought to the explaining of any parallels. For Lyell, it is adaptational considerations alone that determine and so can explain the timing and placing of the coming and going of species. For Darwin, species are exquisitely adapted to their habitations (areas, ranges), stations (habitats) and places in the economy of nature (niches), but he held that adaptational considerations alone do not suffice explanatorily. They must be augmented by supraspecific ancestral and migrational considerations. Such considerations had a place already in Lyell's historical geography for individual species: any Old World species, say, that has flourished in the New World, once taken there recently by man, owes its earlier absence there to its having originated in one place in the Old World and its failure to migrate there unaided. With common ancestry extended to supraspecific groups, Darwin could, in March 1837, explain the absence of whole groups from areas where they could flourish once aided in getting there. It had been, I have guessed, another, earlier geologico-geographical explanatory need for extended, supraspecific common-ancestral considerations that had first inclined Darwin to become a transmutationist in mid -1836; and it is thanks to these new developments of these further needs that his transmutationist convictions are being strengthened so hugely, so unexpectedly, so irreversibly and so consequentially in March 1837.

Lyell had said that anyone considering adopting the transmutation of species would have to confront too all the other theses — continued spontaneous generations of the simplest organisms, escalation over eons from those simplest ones to the highest animals and an ape ancestry for man — all elaborated in what he called Lamarck's system. Lyell meant this point to serve as a warning; but Darwin evidently took it as a challenge from which a grandson of Erasmus Darwin should not shrink. By July 1837, at the opening of his *Notebook B*, he had duly taken the most consequential intellectual decision of his life so far: to elaborate a system of zoonomical theory with the scope and structure of Lyell's version of Lamarck's system. Under the heading *Zoonomia*, the laws of life — the title of his grandfather's best-known work — the first two dozen pages of Charles Darwin's *Notebook B* sketch such a system. All sorts of reflections about all sorts of Galápagos plants and animals now enter in all sorts of ways into that sketch. But that is another story for another time. What needs insisting on here is that although Darwin's implementation of that decision went far beyond any theorising prompted by the Galápagos material alone, the decision itself had been taken directly in the wake of those new interpretations of the archipelago's landbirds prompted by the new judgements communicated by Gould to Darwin in March.[14]

6. Concluding Remarks

It has been argued throughout this paper that any account of Darwin's changing thoughts about species origins — from his first visiting at the Galápagos islands themselves to his rethinkings in March 1837 — has to be analytically and narratively complicated. It will also now be clear that the account given here is indebted at every turn to the researches of Frank Sulloway. However, my conclusions are at odds with those he first reached some decades back and which have been justly admired and widely accepted as authoritative since. The central thesis in Sulloway's account is that, over these two years, Darwin's attitude — positive or negative — towards species transmutation was always correlated with, if not solely conditioned by, his response to a single question about one lot of birds, the Galápagos mockingbirds: are they species or varieties? Accordingly, Sulloway has Darwin in October 1835, at the time of the Galápagos visit, vacillating about that question — species or varieties — about those birds, and therefore vacillating about accepting or rejecting transmutation; while in mid-1836, Sulloway has Darwin deciding for varieties and against species, and so deciding against transmutation; then, finally, with Gould's judgements accepted, Sulloway has Darwin reversing his mind on both questions in going for species and so for transmutations. Now, if the present paper is anywhere close to being analytically and narratively on target, no such scheme as Sulloway's can be accepted; for it does not take adequately into account the decisive changes in the assumptions Darwin was bringing to his engagement with these issues: most crucially, the change from assuming — from October, 1835 to March 1837, and so in mid-1836 — that, if the mockingbirds were distinct species from one island to another, then they were species original to the mainland not to the archipelago, to assuming, after Gould's input, that they were indeed distinct species and moreover different from any on the mainland and so original to the Galápagos.[15]

As for my account, it has some straightforward moments that may be worth recalling here. For more than a year before the Galápagos visit in September and October 1835, Darwin had embraced Lyell's geological views and had had no disagreements with Lyell's special creationism concerning species, nor then with Lyell's rejection of species transmutations. Moreover, Darwin had no such disagreements when at the archipelago. By contrast, if we fast forward to March 1837, several months after his return to England, Darwin is showing himself to be now a completely and confidently convinced transmutationist in his *Red Notebook*. The interaction with John Gould concerning the Galápagos birds has contributed decisively to this new complete confidence. Next, sometime between early March and his opening of his *Notebook B* in July, Darwin took the most consequential intellectual decision of his entire life: he would side with Lamarck rather than Lyell on the organic world, and work at elaborating a system of theory with the scope and structure of Lyell's version of Lamarck's system.

So far so straightforward, at least in recapitulationary outline. But what about those months between visiting the Galápagos and interacting with Gould? What about Darwin's engaging with the issue of species transmutation in his reflections on the Galápagos mockingbirds in his *Ornithological Notes* in mid-1836? I have concluded that he was already favoring transmutations before recording those reflections, and was then looking to some prospective support for that view from archipelago zoology. But why was he already a transmutationist at that time? I argue that his first shift to favoring transmutation had most likely already been made shortly before; but that it would not have been prompted by any thoughts he was then having about the Galápagos birds. We will probably never know what other reflections on what other facts had prompted that shift. My guess is that the decisive new reflections did not concern any islands; rather these new thoughts may have concerned the geographical distribution of some genera of birds observed and collected by Darwin

years earlier, on the mainland of southern South America. So, my guess is that it was reflections on these genera, reflections first made in mid-1836 just before the mockingbird entries in the *Ornithological Notes*. This guess is only a guess but it could help explain why Gould's later judgements on the Galápagos bird specimens were so massively influential. Gould's judgements — quite unexpectedly for Darwin — meant that these archipelago birds now raised the same issue about the origins of species that had been raised for Darwin, according to my guess, by those mainland genera: the issue of why very similar species had originated in places with very dissimilar conditions.

Finally, what of Darwin's own recollections of his changing thoughts about species origins during and after the voyage? The pertinent passages in the *Autobiography,* in the *Origin* and in *Variation under Domestication,* and similar passages in letters, are now well-known to project back, into the voyage years, judgements and inferences not made until after Darwin got back to England. So, these passages can make no contribution to any historians' quests for biographical alternatives to anachronistic retrospections. Darwin wrote late in life to a German correspondent, who had asked about the early development of his thinking, that when on the *Beagle* he "believed in the permanence of species, but, as far as I can remember, vague doubts flitted across my mind." In its own vagueness this memory is consistent with the analysis given here. Much earlier, in 1844, he told his friend Leonard Jenyns that he had first approached the subject of species mutability not from "the difficulty in determining what are species & what are varieties" but, rather, "from such facts, as the relationship between the living & extinct mammifers in S.America, & between those living on the continent & on adjoining islands, such as the Galápagos." This account plainly recalls early March, 1837, rather than any voyage moments, as it emphasises resemblances between mainland and island species rather than differences among island species or varieties. Even earlier, in his own personal journal, writing most likely in August 1838, he explicitly recalled opening his *Notebook B* in July 1837 — what he identified here as "my first note Book on 'transmutation of species' " — after having been "greatly struck" from "about … March" that year "on character of S. American fossils — & species on Galápagos Archipelago." He continued: "These facts origin (especially latter) of all my views." Again, this phrasing indicates a recollection of being most impressed not just with Gould's mockingbird judgements in particular, but with the generalisation drawn from many instances, including the mockingbirds, concerning resemblances among distinct species on the mainland and on the islands.[16]

If we look back and ask ourselves what do these recollections leave out that we have had to include, one short answer is inevitable because it leads to so many indispensable complications and conjectures. That short answer is, obviously, Lyell's views. That short answer is an obvious answer but not a superficial one, if only because it is grounded in an observation familiar to all who have concerned themselves with the intellectual lives of scientific theorists: such theorists, even — perhaps especially — the very innovative ones, often make up their minds about the way the world goes by working out how far they can agree, and how far they must disagree with views already put in play by others. The parallel is absurdly hubristic, but if this paper is at all successful then its complicating and conjectural proposals about Darwin will provoke rewarding agreements and disagreements for some Darwin buffs to engage as they recover from their bicentennial fatigue.

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ent paper supplements two earlier ones of mine often travelling over the same ground, Hodge 1982 and 1990.The second of these papers corrects consequential mistakes made in the first, including mistakes about Darwin's mid-1836 views about the mockingbirds, errors pointed out by Sulloway's publications at that time. This second paper defends most of the main views I have argued for here, while explaining more fully my agreements and disagreements with Sulloway's conclusions. These papers also document more precisely my debts to Ghiselin, Herbert and Kohn. Both papers, reprinted in facsimile in a volume published recently, Hodge 2009a, develop extensively the theme that has had to preoccupy this paper: how Darwin in 1835-7 was often working out his thoughts about what he found in the world by reflecting on his agreements and disagreements with what he found in Lyell's *Principles of Geology* [17].

Most of Darwin's writings from the 1830s, including notebooks that are still unpublished in printed editions — often together with transcriptions and editorial and bibliographical commentary — are now available at the invaluable website directed by John van Wyhe: *The Complete Work of Charles Darwin Online* (darwinonline.org.uk/).

End Notes

1. Hodge 1982 and 1990. Everything said here about Lyell's views is documented in the first of these papers. On Darwin and Lyell's geology, see now Herbert 2005. For comprehensive and detailed accounts of Darwin and the Galápagos, see Sulloway 1984, Darwin 2009 and Grant and Estes 2009. For a concise, general account of Darwin's thinking before and during the voyage years, see Sloan 2009.
2. Hodge 1982:6–13 and 28–35.
3. Hodge 1990.
4. *Zoology Notes*, MS pp. 340, 328 and 341, in Darwin 2000:296, 291 and 298.
5. Darwin 1989:356; *Zoology Notes*, MS p.340, in Darwin 2000:297; *Galapagos field notebook* MS p. 30b, in Darwin 2009:439; Darwin 1985:485. On all of Darwin's diaries, journals, notebooks, specimen catalogues and other records from the voyage years, see the editors' account in Darwin 1985:545–548.
6. *Ornithological Notes*, MS pp.71–4, in Darwin 1963:261–2. For the dating of these notes, see Sulloway 1982b:327–337; for Darwin's changing views on the finches, see Sulloway 1982a.
7. Hodge 1990:273; Sulloway 2009:23–24. Here, I am agreeing with Sulloway in disagreeing with Kohn et al. 2005.
8. See Chancellor and van Wyhe's commentary in Darwin 2009:410.
9. *Ornithological Notes,* MS pp. 64–9, in Darwin 1963:255–259. Some birds of this genus were called Antbirds. For detailed discussion of them, see Herbert's notes in Darwin 1981:111–115 and Sulloway 1982b:374.
10. For full documentation and extensive analysis, see Sulloway 1982b:362–374.
11. Darwin 1839:461–462. For a detailed account, see Sulloway 1982b:362–374.
12. *Red Notebook,* MS pp. 127 and 130, in Darwin 1987a:61–63. For the dating of these entries see, Darwin 1981, Sulloway 1982b and 1983, and Darwin 1987a. For Darwin's consultations with Owen, see Brinkman 2010. This very informative paper suggests that while still on his voyage Darwin inclined toward species transmutations on paleontological grounds. I am unpersuaded and would stand by what I said about Darwin's paleontology in Hodge 1982, an account not discussed by Brinkman.
13. *Red Notebook,* MS p. 133, in Darwin 1987a:63. Details in Hodge 1982:43–50.
14. Hodge 1982, 1990 and 2009d.
15. Sulloway 2009 reaffirms the views set out in Sulloway 1982b, but without referring to the agreements and disagreements with those views in Hodge 1990.
16. See volume one of Darwin 1903:367; Darwin 1987b:85, and Darwin 1986:431.
17. Likewise for the early Wallace too: a main challenge came in disagreeing with and replacing Lyell's view that, on a neoHutonian earth's surface, adaptation alone determines the timing and placing of the continual origins and extinctions of species, and so — together with constantly changing avenues and barriers

to migrations — determines the temporal and spatial representations of supraspecific groups. For detailed comparisons of Darwin and Wallace on this very general issue, see Hodge 1991; for a brief introduction, see Hodge 2009b and c.

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