Programs, Bugs, DNA and a Design Argument

Alexander R. Pruss
May 27, 2004

e-mail: *ap85@georgetown.edu*
Department of Philosophy
Georgetown University
Washington, DC 20057

Abstract

I argue that an examination of the analogy between the notion of a bug and that of a genetic defect supports an analogy not just between a computer program and DNA, but between a *computer program designed by a programmer* and DNA. This provides an analogical teleological argument for the existence of a highly intelligent designer.

1. Introduction

Prima facie, there seems to be an analogical argument from the claims that DNA is like a computer program and that computer programs have programmers, to the claim that the DNA of an organism has a designer. This is a teleological argument. But unfortunately an unsound one: some computer programs do not have designers, but are themselves generated by other programs, perhaps in a random way. If it is countered that in these cases there is still a programmer behind the scenes who wrote the initial programs, then a defeater comes up: there is a crucial disanalogy between the case of DNA and computer programs, in that in the case of DNA we know of a process, namely neo-Darwinian evolution, that could be reasonably thought to produce the DNA without the intervention of an intelligent being, while we do not know of such a process in the case of a computer program.

I will argue, however, that the analogical argument can be rescued if one fleshes out the analogy further, by showing that if there were computer programs that were not themselves designed by intelligent agents, they would lack certain normative characteristics that designed computer programs have, and then by arguing that DNA exhibits these same characteristics. Moreover, these characteristics of designed computer programs are such that we do not know of any natural process that does not involve an intelligent agent which could produce a program with them. This strengthens the analogical argument. It will turn out, I

expect, that the main question for debate will be whether in fact DNA has the characteristics in question.

2. Bugs and features

I am on the development team for two free software projects, Plucker[1] and PalmBible+[2]. In the case of each project, we receive "bug reports" and "feature requests" from users. In the case of the Plucker project, which is an off-line web browser for PalmOS PDAs, we encourage the bulk of the reports to come through our bug tracker web site[3]. A user making a request from the development team, needs to describe the issue sufficiently clearly for us to understand and hopefully duplicate. Moreover, she needs to classify whether the request is a bug report, and of what severity, or a feature request. Once we receive the report, we may do several things. We might reclassify a bug report or feature request. We might immediately resolve a bug report, marking it as "not a bug", and explaining why. Or we might, immediately or later, fix the bug or add the requested feature. In the case of the PalmBible+ project, a Bible reader for PalmOS, similar considerations theoretically could be applied, but most reports and requests go through an informal web-based forum.

The distinction between a bug report and a feature request is of practical relevance to both development teams. For instance, both projects go through periodic feature freezes during which the focus is on fixing bugs rather than adding possibly buggy code that adds new features.

To see the distinctions at work, consider some particular cases from the Plucker project. User "KYSoh" filed report #708 stating: "Hires Plucker v20030611-am is displaying a black dot after I scroll to the end of a document on my Palm m515." The user classified this as a major bug. Less than four hours later, user "Belousov" posted a follow up: "It's not bug, it's a feature! This dot is mark of bottom previous page." An hour and a half later, I set the bug report status to "resolved" with a resolution of "Not a bug." The issue was that when paging through a web-page, because the text on the last screen may have significant overlap with the data on the previous screen, a square is drawn in the margin to guide the reader's eye to new text. At the same time, I also noted in my resolution note that if the dot annoyed the user, the user was free to file a feature request to allow users to configure if they want the dot or not.

There are a couple of things worth noting here. First, there really is a distinction between a bug, something that should not be there in the program, and a feature. This is true even if the feature, like the black square in question, annoys some users. Second, the distinction is epistemically accessible, though fallibly, even to users like "Belousov" who quite possibly did not have to look at the source code for the program, read the documentation (which unfortunately does not mention this feature), or talk to any of the developers, but who treated the program as a black box. User "Belousov", I am assuming, found that the square appearing on the margin served a useful purpose, and inferred that the square was a feature, not a bug. Nonetheless, this inference was ampliative. It could have been the case that the square appeared there due to a bug in the scrolling code, say, and simply *happened* to serve a useful purpose. My own inference that this was a feature was more certain than one based on a black box type analysis, because I had seen the lines coding for the feature in the source code, and thought, defeasibly but with great confidence, that these lines were deliberate and correct.

For a different example, consider report #1058, by "mrdurdensir": "Have been a fan of [Plucker] since I got my T3 and you chaps have not bothered to support the T3 DIA Landscape & [Portrait] views." This was filed as a report of a major bug. However, this was an incorrect classification, once again.[4] Plucker ran just fine on the PalmOne Tungsten T3 model, but simply did not expand its display when the screen size on the T3 was stretched by opening a slider. In other words, the program did not do something that the user wanted it to do, something admittedly desirable. It did not do this because this capability had never been put into it. There was thus some desirable functionality that was missing at the time of the report, and several months later it was added in, but its being missing was not a bug.

On the other hand, sometimes something is filed as a feature request, whereas in fact it reports a bug. User "loyukfai" filed report #785 headed "Search Function Cannot Find Any Chinese Text". While this was filed as a feature request, viz., a request that Plucker be able to search through Chinese texts, that Plucker was failing to search Chinese texts was in part due to the fact that code I had written for detecting systems with certain international character sets was insufficient and in part due to a problem in third-party Chinese support software. It would have been reasonable to consider this a bug report.

We thus have a three-fold distinction, between bugs, features and missing functionality. The distinction is important to software development work and appears to be objective to some degree, at least in the sense that one can be mistaken in one's classification. Note, too, that while bugs and missing functionality tend to have disvalue and features tend to have value, this is not sufficient to ground a distinction between features on the one hand and bugs or missing functionality on the other. After all, a feature can annoy the majority of users, and still be a feature, though a misguided one. For instance, an older version of Microsoft Word would guess if the user were typing a letter and annoyingly ask the user if she wanted help with writing a letter—many users resented this and Microsoft eventually removed the feature. Conversely, a particular bug might actually please some users, and it is conceivable that it could please the majority of users. For instance, if due to a bug in Microsoft Word the query about helping the user with writing a letter disappeared after three appearances, this might well have pleased the majority of users. Similarly, missing functionality might render a program smaller and faster, and if the user does not care about the functionality this might be an improvement.

Thus, our distinction, though a normative one, cannot be made solely in terms of the value that an aspect of the program has to the users. Nor can it be made in terms of the value that it has to the developers. A software development team, against its better judgment, may have to implement a feature requested by a boss, even though neither the team nor the user community likes the feature.

The fact that there may be unclear cases, such as whether the problem with searching Chinese text was reflective of a bug on the part of my code for failing to detect some Chinese systems or was a report of my code's lacking the functionality to detect Chinese systems that fail to properly report their internationalization to other programs, does not undermine the fact that there are clear cases. The square on the margin really was a feature and not a bug. The failure to take advantage of the T3's stretch screen was indeed an instance of lack of functionality and not a bug.

Next, observe that a characteristic shared by two programs identical byte-by-byte can fall under one of the three descriptions "bug", "feature" or "an instance of missing functionality" in the case of one program and another one of the descriptions in the other case. Consider as a hypothetical case Plucker*, a program

byte-by-byte just like Plucker, but where the programmer never intended to implement a marginal square to mark the start of the last part of the text viewed. However, the programmer wrote a part of the Plucker* code by cutting and pasting lines of code from another project—a not uncommon procedure—and accidentally included the code that in its new context produced the marginal square. Then, the square would be a bug in Plucker* and a feature in Plucker, despite the two programs being qualitatively identical byte-by-byte. Or suppose that program A was written by a programmer who intended her program to work not just on Windows XP but also on Windows ME, but that in fact only worked on Windows XP, and program B was written by a programmer who intended her program to work only on Windows XP. It is quite possible that both programs in fact work only on Windows XP, and that they are in fact byte-by-byte qualitatively identical.

The last two examples suggest that the way to figure out whether something is a bug, a feature or a piece of missing functionality is to look at the intentions of the developers. It may, however, be more complicated than that. There may, for instance, be an interaction between the intentions of the developers and social standards. Thus, there might be a reasonable expectation that a program should do something, e.g., not crash a computer, and the fact that a sloppy developer just did not care whether her program would crash computers occasionally perhaps does not make the crashes be something other than bugs. However, even here the developer's intentions, or at least those of her employer, are *relevant*. It might count as a bug in a computer virus if it fails to crash or otherwise damage the system it is running on. Moreover there could be, and no doubt is, specialized software that for testing purposes induces crashes.

All this makes highly plausible the claim that if a program appeared randomly on my computer, e.g., due to random cosmic ray bombardment of my hard drive, while I would be able to make a distinction between its doing what I want and its not doing what I want, I could not make the distinction between bugs, features and missing functionality. What is of greatest interest to me from now on is that I could not make a distinction between, on the one hand, a bug and, on the other, a feature or missing functionality. Given that a byte-by-byte duplicate of the code can be buggy if produced by a programmer with one set of intentions and not buggy if produced by another with other intentions, it does not appear that there is any hope for figuring

out what is a bug and what is not. I cannot tell if the system is correctly following a rule that it is undesirable for it to follow or if it is incorrectly following a rule that it would have been desire for it to follow.

Observe, however, that despite this, in practice judgments can be made about whether something is a bug or not without querying the developers. Recall the case of the marginal square which a user figured out to be a feature, despite the developers having failed to document it as such, and how I then confirmed this on the basis of internal features of the code. In the case of a program that was produced by cosmic rays, both the behavioral and the internal grounds would remain. Thus, it would be possible to make a distinction between a bug* and a feature*, where a bug* is something that looks behaviorally or internally like it would be a bug if the program came from a programmer, and a feature* is defined similarly. However, a bug* is not the same as a bug, since both kinds of grounds can lead one astray. Something may look to all users like a bug, and yet be a feature, and the code for it can look like buggy code even though it is perfectly correct, as we would find out if we queried that developer who actually wrote it.

But even though these kinds of assertibility conditions that do not consider intentions are insufficient as truth-conditions for a claim of bugginess, the existence of these conditions shows that it is possible to make judgments about bugginess without communication with the developer.

3. DNA and a designer

Like computer programs, DNA directs complex functioning in a system. Now, is DNA like computer programs *simpliciter*, or is it more specifically like *designed* computer programs? Designed computer programs, we have seen, have the normative characteristic that they are subject to evaluation for bugginess. I claim that the same is true of genetic material where we have the category of a "genetic defect or disorder"

A genetic defect or disorder is not an instance where something occurs in an organism contrary to the DNA. That indeed would not be akin to a bug, but would be more like a "hardware error." In the case of a genetic disorder, the DNA codes for certain things which in fact are produced, but these things, such as two sides of the palate failing to meet, are undesirable. However, undesirability is insufficient to define a genetic disorder. If "undesirable" is understood as "socially undesired", then we have the absurd conclusion that we could bring it about that there are no genetic disorders simply by lowering our expectations.

On the other hand, if we are using an objective sense of "undesirable", as implying an objective badness, then there are *prima facie* counterexamples. Our DNA guides our development in such a way that we do not grow prehensile tails. The failure to grow prehensile tails is objectively undesirable, since it is *prima facie* objectively desirable that humans should have prehensile tails—they would enable them to better engage more easily in various activities that are now rather difficult, such as taking care of twins or using a computer mouse while typing with both hands. The desirability here is only *prima facie*. It may be that if I had a prehensile tail, I would find shoplifting too easy and hence too tempting to withstand or I might find life less challenging and hence less interesting, and therefore the net effect on me would be negative. But once one admits such *secunda facie* considerations, then it is no longer clear whether, say, different things that we class as "disabilities" are really undesirable, since they can lead people who have them to develop various moral virtues, such as perseverance, humility, and so on.

So just as software bugs cannot be defined in terms of desirability, neither can genetic disorders be. Some of our attitudes towards software bugs parallel our attitudes towards genetic disorders. It may be "a pity" that a program lacks some functionality or that I not have a prehensile tail, but that this is so is not positively bad. But a bug or genetic disorder is intrinsically a bad thing for a program or organism to have. But of course the program or organism can be good overall despite the bug or defect. Moreover, it might sometimes be better that a program or organism should have a bug or defect—think of how good it is if a computer virus infecting my computer doesn't work or if the tiger that is sneaking up on you is, due to a genetic disorder, lacking in claws and teeth. In the case of an undesirable bug or an undesirable genetic disorder, we feel that something has gone wrong. In the case of an instance of missing functionality or of, say, an organism's innate inability to cope with certain environments, it is not so much a matter of something having gone wrong, as of something not having gone right.

It seems deeply plausible, though this may be controversial, that there is an intrinsic difference between a doctor surgically treating cleft palate and a doctor attaching a prehensile tail to a person. Yet under certain circumstances, both could result in an equal improvement of quality of life. For instance, suppose that you live in a poor area where there is a very high unemployment rate, but having a prehensile

tail would enable you to find a form of employment that keeps you from starving to death. One way to see the difference is that we would talk about surgical "correction" of cleft palate, but we would not talk of the attachment of a prehensile tail as a "correction." The former is akin to a work-around for a bug, where the bug remains but a way is found for the software to still do what one wants it to, whereas the latter is like an extension to the software.

Conversely, there seems to be a *prima facie* badness in parents genetically modifying the egg and sperm in such a way as to bring it about that the resultant person should have cleft palate, which badness would not be shared in by, or would not be shared in in the same way by, the actions of parents who found that their genes were such as to produce a child with a prehensile tail and who had the genetic material modified to remove this possibility. This is true even should it be the case that the community was such that the child would be much better off with the tail. For instance, imagine that local dress codes were such that the child and parents could ensure that no one would find out about the tail until the child grew up, at which point the tail would greatly improve the child's quality of life.

This suggests that there is an analogy not just between the DNA of organisms on earth, specifically our DNA, and computer programs, but between this DNA and those computer programs that support a distinction between bugs and non-bugs. But those computer programs that support such a distinction are precisely those that are *designed* by an intelligent agent. Hence, by analogy, our DNA is probably designed by an intelligent agent.

Insofar as the designer of our DNA would have to be a highly sophisticated intelligent agent, this is a teleological argument. Moreover, if one thinks that there is strong evidence that our DNA evolved under the guidance of apparently naturalistic processes from the DNA of an initial simple organism, then this intelligent agent has to be the sort of being that is capable of intentionally producing our DNA through such processes. Now while a pretty smart Tau Cetian *might* be able to design human DNA from scratch, to set things up so that human beings would arise through a billion years of apparently naturalistic processes *and yet* be the product of design would take more than just a pretty smart alien. If the processes behind evolution are in fact essentially deterministic, it would seem to require a being capable of predicting ahead of time the results of a

billion years of such processes. If the processes essentially exhibit quantum randomness, then the being would have to be either capable of predicting how indeterministic processes would turn out, no mean feat, or of affecting the outcomes of quantum mechanical experiments, again a difficult task. Thus, the intelligent being would have to be quite powerful and/or intelligent indeed.

4. Some objections

i. "The distinction between genetic disorders and non-defects is purely subjective." This simply denies my basic intuitions here. If these are denied, then the argument indeed fails. But it is important to see the manifold consequences of such a view. It threatens, for instance, to undercut the distinction between a doctor's enhancing something and a doctor's correcting something, a distinction particularly important to HMOs and to societies with socialized medicine, and indeed one with far-reaching consequences in medical ethics. Likewise, it destroys the rational basis for our common social attitudes towards genetic disorders, attitudes that imply that there is a special badness in producing them. These attitudes, in fact, apply not just in the case of humans, but in the case of animals, though there, depending on our views on animal experimentation, we may take the badness not to imply indefeasible claims of illiceity.

ii. "This argument for a designer is circular, because if the notion of a bug depends on the programmer's intentions, then the notion of a genetic disorder depends on the designer's intentions, and so we cannot know that something is a genetic disorder unless we already know that there is a designer." This is a variant of the first objection, attempting to get out of my argument by denying that there are genetic disorders. Moreover, this response neglects the lesson learned from the computer case that one can figure out that something is a bug *without* direct access to the programmer's intentions—but the evidential grounds of this judgment are then not the same as the truth grounds.

iii. "If the universe is created by God, why are there any genetic disorders? Aren't genetic defects an argument against the existence of God?" This is not an argument against the conclusion of the argument I give in this paper, but an argument against what the reader may conjecture to be my ultimate concern—making plausible the existence of God. The question of why God permits there to be genetic disorders is only relevant to arguing against the conclusion of *this* paper if there is a good argument from the claim that

the species here on earth are designed by an intelligent being to the claim that there is a God.

But I will bite, since *in persona propria* I think there is a God and I suspect, though I do not argue so here, that such an argument as described could be given if one combined this argument with other theistic arguments.

One can expand on the worry about God and genetic defects in two different ways. First, that if God's intentions are definitive of the notion of a defect, then if God intends something to happen, it is not a defect. But if God is the creator of the universe, then he intends the features we call "genetic defects or disorders" to be exemplified. Hence, they are not defects, and the argument is undercut. This argument, however, neglects the fact that intentions are an intensional phenomenon. One can intend something under one description and not under another. Thus, a programmer working under a deadline may release a buggy program, knowing it is buggy, and intending that this program be the one that is sold. The bugs are, nonetheless, bugs. The programmer's intention to release *this build of this program* does not filter through to an intention to release *this buggy build of this program*, which would make the bugs intentional and indeed endanger their status as bugs. Furthermore, as we saw, the relationship between the programmer's intentions and the notion of a bug is actually not as simple as it might seem at first sight.

Now, it may be argued that God does not operate under such limitations as programmers do, and hence there is no excuse for non-intentionally present bugs. This leads to the second argument, namely what sort of excuse a perfectly good being would have for producing a world containing genetic defects. Conceptually, we might start by noting that genetic disorders are only *prima facie* bad, or that they need not be violations of any rights that the beings subject to these disorders have, and need not even be instances of God's being less than perfectly kind to creatures, especially if it could be argued that the beings would not have existed without these disorders.[5] If one is pressed further for the sorts of reasons that God would have, one is thereby pushed into the realm of theodicy. And for that, alas, there is no room here. All I can do is point towards what I consider to be the most plausible philosophical candidates for theodicies, the cumulative theodicy of Alston[6] and the Irenaean theodicy of Hick[7].

iv. "The distinction between genetic defects and non-defects is purely statistical." On this account, if

Einstein's high intelligence is genetically grounded, it is a defect since it is statistically abnormal. More need not be said about this absurdity.

iv. "Evolutionary natural selection gives us a way of distinguishing between genetic disorders and bugs. We can take a genotype as *correct* provided that it has been selected for through the selective benefits of its associated phenotype, and this normative notion of correctness is sufficient for underwriting judgments of genetic defectiveness or non-defectiveness." Unfortunately, this stories, and ones like it, do not do justice to how we use terms like "genetic disorder" or "genetic abnormality". Suppose that Lucy has, for genetically grounded reasons, slightly sharper vision than any human being has ever had before, and we are considering Lucy before she has any children. The DNA code responsible for the incremental improvement in vision has *not* been selected for through the selective benefits of its associated phenotype, viz., the improvement in vision, because natural selection has not yet had a chance to work. At this point, then, it appears that we cannot say that the relevant parts of the DNA are correct.

One might try to remedy the problem by adverting to the future and saying that a genotype is correct if it *will* be selected for. However, it is implausible to suppose that judgments of genetic abnormality depend on contingent future events. Moreover, this solution has the even more implausible consequence that if Dr. Evil deliberately forces people who exhibit something that we would all consider a genetic disorder—say, genetic coding producing congenital blindness—to reproduce, then not only will this genotype *become* correct because it will be selected for, which may not be plausible, but it will *have been* correct even before Dr. Evil embarked on his cacogenic project. If it is retorted that a distinction between artificial selection and natural selection must be made, and only genotypes selected for or about to be selected for via *natural* selection count as correct, then we get the implausible conclusion that dogs are genetically incorrect insofar as they differ from wolves. Moreover, one can replace Dr. Evil with an unconscious and unintelligent robot that exhibits the behavior that Dr. Evil in fact exhibited. Since the robot is unintelligent, it won't behave in all counterfactual situations the way Dr. Evil does, but that should not matter unduly here as long as the robot is capable of ensuring the success of the cacogenic project.

Nor will it do to replace actual future natural selection with merely potential natural selection, by

saying that the genotype is correct if it could be selected for, since any genotype that does not render the organism that has it utterly incapable of reproduction could be selected for—and kin selection effects might even allow for that.

But perhaps we can get around the counterexample of Lucy by saying that while the incremental improvement in the sharpness of her vision was not selected for, having sharp vision was naturally selected for, and the genetic basis of a quantitative improvement in a feature selected for by natural selection *also* counts as correct. The notion of "improvement" here is perfectly straightforward: If a genotype *g* was selected for because it produced a phenotype *f* which aided the passing on of the genotype by fulfilling function *F*, where the function *F* is something that comes in degrees, like moving quickly or seeing sharply or thinking creatively, then we can talk of genotypes that merely lead to a quantitative improvement in *f*'s fulfilling *F*.

This does mean, however, that if Lucy had eyesight and none of her ancestors did, because this would not be a merely quantitative improvement, Lucy's eyesight would be genetically abnormal. Now, it would be very strange to call the eyesight genetically *defective*. But the defender of natural selection as definer of defectiveness can say that a genetic disorder is not just any genetic abnormality, but one that confers a selective disadvantage. This would imply that should there be a situation where cleft palate does not confer a selective disadvantage, it would not be a genetic disorder but only a genetic abnormality, no matter how much suffering it caused the individual, and this surely is not right. Nor will it do to say that a genetic disorder is a genetic abnormality that *would have* conferred a selective disadvantage had it occurred in an ancestral organism. For it may be that Lucy's ancestors, by chance unlike Lucy, lived in a dark area of the ocean where sight would only be a disadvantage—yet another thing that could go wrong and cause confusion.

v. "Perhaps, though, there is a *metaphysical* matter of fact about an organism or natural kind as to what is natural to members of that natural kind." Objectively, for instance, an organism might have an Aristotelian substantial form that does not merely supervene on the arrangement of matter in the organism and that specifies what is a defect and what is not. This does not conceptually require a designer and hence shows a

disanalogy with the computer program case.

This objection, however, while showing one disanalogy highlights the analogy: namely, the lack of supervenience of the normative defect/bug claims on the descriptions of the stuff constituting the organism/program.

Furthermore, one would like there to be an explanation for why it is that at some point the descendants of two animals of one species should be of a different species, with different normative properties. At some point in the evolutionary history a transition was made from being the sort of organism in which *F* was abnormal to being the sort of organism in which *F* was normal. Saying that the claims about normalcy depend on deep Aristotelian metaphysical facts about the animals simply raises the question of how *these* facts evolved.

It may be easy to explain why the DNA of the descendant organism was as it was. We can just cite the mutations and recombinations that led up to this. But to explain why that descendant organism had one kind of substantial form rather than another—that is surely beyond the competence of a science at all like ours. Yet, surely, it is also not a coincidence or a merely brute fact that such change at the normative level accompanied change in the molecular structure. This gives strong plausibility to supposing that there *is* an explanation of the change in the normative features, and that the explanation is not scientific in nature. But following an insight going back to Swinburne[8], the only other kind of explanation than the scientific that we know of is explanation in terms of the agency of an intelligent person. Moreover, no intelligent person that we know of has the power to effect this kind of change at the normative level, e.g., to bring it about that an organism has one substantial form rather than another. We can only bring about changes at the physical level, e.g., in breeding, and then *somehow* changes at a normative level might follow. It seems like a radically different kind of being than us would be needed to instill substantial forms and set things up so that an organism would have one kind of substantial form rather than another.

Could one claim as an alternative that just as there are contingent laws of physics, so too there are contingent laws of the normative realm that have no further explanation? It seems to me that to stretch the idea of laws of nature to a realm as different as the normative is from the descriptive would seem quite a

stretch indeed. Moreover, the coordination between the physical and normative laws, so that normative change would be appropriately correlated with physical change in DNA—once one species evolves into another in terms of DNA, we surely have reason to think that there has been a normative change, too—would call out for an explanation.

5. The main issue

The basic conceptual difficulty seems to come from the fact that we have two different normative measures for genes of animals. On the one hand, there is the notion of natural selection, so that a gene counts as correct if it is selected for, or would be selected for, or will be selected for, or something like that. On the other hand, there is the notion of flourishing, and we might say that a gene is correct if it contributes to flourishing. It is clearest in the case of humans that the two notions need not go together, but this is also true in the case of non-human animals. Consider an animal that breeds poorly in captivity but is tasty to humans. If the animal develops in such a way as to be better capable of breeding in captivity, then it is likely to become the subject of factory farming, which will lead to large scale genetic success for the species. If, however, the animal continues to be incapable of breeding in captivity, its species may be genetically less successful. But at the same time, if one thinks that factory farming does not contribute to the flourishing of the animals thus farmed, at least with the animals considered in and of themselves[9], this is a case where the same feature would detract from flourishing and yet be a selective advantage.

Moreover, it appears that our ordinary notion of genetic disorder is more closely tied to the notion of flourishing than to genetic success. Observe, for instance, how those who believe that homosexuality does not impede the living of a flourishing human life will also insist that even if homosexuality is genetically grounded it does not constitute a genetic disorder, and would insist this even if in fact it were to turn out to impede genetic success. Of course, homosexuality might not impede genetic success once one accounts for kin selection effects and the like, but the judgment by those advocating gay rights that homosexuality is not a genetic disorder is not made on the basis of such empirical claims about genetic success, but on the basis of their (controversial) intuitions about human flourishing.

Yet, nonetheless, it is not the case simply that a genetic disorder is a genetically grounded feature that

fails to contribute to the flourishing of the organism. It is not a genetic disorder for me to lack wings or superhuman intelligence, even were it shown that I would flourish more were I to have wings or such intelligence. Nor will it do to respond to this example by saying that wings could not help me to flourish *humanly*. Plainly they could. In Hayao Miyazaki's anime film *Kiki's Delivery Service*, a 13-year-old witch starts a delivery service, flying errands on her broom. As we watch the film, we see how Kiki grows as a *human being* through how she deals with issues arising from her magical skill. If she had wings instead of magic, much the same plot could be used. One can grow and flourish humanly with the help of features not normal to humanity.

Nor can we set some "standard" level of flourishing for an organism and say that a genetic disorder is a genetically grounded feature that moves one below that level. After all, one can have a genetic disorder and stay far above any "standard" level of flourishing.

But perhaps we can define a genetic disorder as a feature that in its *direct* effect decreases our human flourishing. My not having wings does not directly decrease my flourishing, though it may indirectly do so. However, even this is not so plausible. For instance, the *direct* effect of our having a pain center in the brain, no doubt a genetically grounded feature, is our feeling pain, and it is plausible that feeling pain directly decreases human flourishing, even though it perhaps remotely increases flourishing by informing us about damage to our bodies, and even more remotely does so by making possible aspects of virtues such as courage. And yet our having a pain center is surely a *normal* feature of us, not a bug. Likewise, the direct effects of my heartbeat are (a) movement of blood through the heart, which does not contribute to my flourishing directly but only indirectly once the blood moves through the rest of my body, as well as (b) the using up of energy, which perhaps contributes negatively to my flourishing. It does not appear possible to separate out the direct and the indirect effect in a way that makes for a viable distinction between the normal and abnormal.

So defining the notion of a genetic disorder or defect purely in terms of our flourishing also fails, just as defining bugs in terms of the good that computer programs bring to us failed. The analogy, then, is quite tight. In fact, one can argue that in experiments—which have been done—where computer programs arise

purely through simulated natural selection processes, precisely the same conceptual issues arise for the notion of a "bug" as we saw coming up for a natural selection account of a genetic disorder or defect. It would seem that in such contexts, the notion of a bug or disorder would be inapplicable.

If in fact the notion of a genetic disorder *is* applicable—our normative reasoning depends on it—we do have a tight analogical argument for the species on earth being designed. And hence there is a designer. What is this designer like? No doubt highly intelligent. What more can we say? That would be the subject for another paper. And is the idea of a designer compatible with the empirical data we have in favor of evolution? That depends on whether one construes evolution in such a way as to make it be incompatible with a design behind the process.[10]

---

[1] www.plkr.org

[2] palmbibleplus.sourceforge.net

[3] bugs.plkr.org

[4] This report was not in fact reclassified, because it was immediately resolved as essentially a duplicate of an earlier feature request.

[5] Cf. Robert M. Adams, "Must God Create the Best?", *Philosophical Review* **81** (1972), pp. 317–332.

[6] William P. Alston, "The Inductive Argument from Evil and the Human Cognitive Condition", *Philosophical Perspectives* **5** (1991), pp. 29–67.

[7] *Evil and the God of Love*, revised version (New York: Harper and Row, 1978).

[8] "The Argument From Design," *Philosophy* **43**, pp. 199–212

[9] Certain theists think that the *telos* of non-human animals is to serve humans, and so in some sense the flourishing of the animals may be promoted through factory farming.

[10] Cf. my "Western Monotheism and Evolution", manuscript (*http://www.georgetown.edu/faculty/ap85/papers*).