

Understanding the Nature of Human Behaviour through Genetic Framework

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Introduction

If one wants to understand the behavior and the biology of human behavior, the biology of abnormal human behavior, one is not going to get very far if one decides all one needs to understand is what hormones have to do with behavior, what early environment, what neurons, what evolution, what genes do; instead one should try to integrate all these different approaches (Pfaff et al. 106). This paper will focus mostly on behavior genetics and the key question here is how you figure out if a behavioral trait has a genetic component. And what behavioral geneticists do is not just sit there and come up with evolutionary models and connive a new species and decide, is it going to be pair bonding or that sort of thing; nor do they sit and look at sequences of DNA and transposable genetic elements. What behavioral geneticists look at is patterns of behavior shared amongst relatives vs. non-relatives; what patterns of behavior run in families (Anholt and Mackay 96). As we will see, this is not a trivial question to get at but with the underlying assumption very broadly, if behaviors are more in common amongst relatives than among non-relatives then there is a hint we may be looking at a genetic component.

Back to a caveat that should be abundantly clear which is that there is zero reason to think about genes have something to do with behavior; genes as deterministic, genes as inevitable, genes as meaning things that cannot change that are impervious to environment. Instead, the fact is that the genetic function is utterly intertwined with the environment that regulates it- genes as propensities, tendencies; it is much more sophisticated model of genes, one that is going to become much clearer as we progress through the article.

Analysing the Behavioral Traits: Genes vs. Environment

Now thinking from the standpoint of behavior geneticists, how do you think about patterns of behavioral traits, running among relatives vs. non-relatives; how do you infer something about genes from that. The obvious approach which has been floating around for a long time and is one that is completely unacceptable at this point is the very straightforward notion that ok traits run in families, genes run in families, therefore behavioral traits that are more common amongst relatives and non-relatives. Aha! You have just uncovered a genetic basis, and it should be pretty easy by now to see exactly what the flaw is with that one, not only do genes run in families but environments run in families (Joseph and Ratner 97). It is very unlikely that one of you as a close member of family could be living in a highly developed urban city and the other one in a rural village. Environments run in families, it is impossible simply from the belief that all the people in the family do it, to decide that there is a remotest bit of evidence for genetics.

So, you get the next more sophisticated approach which says that ok instead of just are they relatives or non-relatives, consider the case that one will lay down one's life for one's two brothers or eight cousins, you are more related to close relatives than to distant ones. And thus you share half your genes with the full sibling and you share quarter of your genes with half sibling and less as you get out into your most distant cousin. So now the logic goes that not only does this trait run in family but the closer the relatives are to this individual the more they share these traits of common. So, now we are looking at a genetic trait. Because in this case, it is not clear which genes run in families with a much strict sort of environment that the closer the relative, the more the shared genes; if the closer the behavior shared, that fits the pattern and we know exactly what the problem is there which is not only do genes become more overlapping as you go to close relatives, environments do as well. You were

raised in a much more equivalent environment with your full sibling than with your 27th cousin, this approach does not get you very far either.

What you now begin to shift to is one of the more rigorous tools that is used amongst behavior geneticists and the logic of this one basically runs as follows, if you have two individuals and they are raised in an identical environment and they have different genes, if at the other end pops different behaviors, it cannot be due to environment, it is got to be due to the genes because the environment is the same. Consider the case, schematically two individuals with genetic make ups that differ and a shared identical environment out pop behaviors 1 and 2, two different ones that have to be a way of telling you, that there is a genetic component to this. Two individuals raised in an identical environment, with non identical genes, outcome different behaviors. It cannot be due to environment as it just shows a strong genetic component (Zumpe and Michael 59).

What sort of examples people use for studies like that and that is where you look at two individuals who are pretty plausibly raised in the same environment which is two siblings in one case identical genes i.e., identical twins and in the other case fraternal twins or in the jargon and field of monozygotic vs dizygotic twins, identical twins from one egg. Identical twins have all the genes in common, fraternal twins have half their genes in common and twins of all types are raised in the same environment in the same household. So with the case of comparing monozygotic vs. dizygotic twins, identical vs fraternal, if you see differences there you are seeing differences reflecting with genetics. And if you see differences between individuals being raised in the exact same environment who are fraternal twins then you are seeing differences in genetic influences because the environment is absolutely missing and you better know where the problem is going there.

But for the moment let us assume that and the studies have shown are things like the incidents of certain psychiatric disorders as a function of whether you are comparing identical or fraternal twins. And what the study shows are a number of cases you see a difference for example, major clinical depression (Russell and Jarvis 72). You take somebody who is clinically depressed and has a long history of it and they have got a fraternal twin, what is the likelihood of that twin having the same depression; about a 25% chance. Now a person has depression and you look at their identical twin, what is their chance of the second one having the depression as well, 50%. You double the risk of the disease when you double the degree of relatedness.

And similar patterns like that have been shown for a number of psychiatric disorders, obsessive compulsive disorders etc. Consistently in those cases what you see is the likelihood of sharing a trait is less between fraternal twins and identical twin. The only thing that differs about them is the amount of genes they share in common and therefore if the degree of which they share behavior is changing also; it is due to the genes because they have got the identical environment. And what is obvious the confound there is identical twins and fraternal twins are not raised in equivalent environments, the differences in treatment of non-identical twins of fraternal twins is much greater than how identical twins are raised. Identical twins are raised in a far more similar environment than are fraternal twins, especially if the fraternal twins are of different genders and suddenly what seems like a full proof way of detecting a genetic influence or if you are looking at environment, let alone the interaction of the two so that is a problem there (Durand and Barlow 223).

Gender Genetics: Truth vs. Hype

But this approach has been used in other realms as well. For example, if you look at the whole notion that there is gender differences in behavior and you ask well genders differ genetically, you got that XX chromosome vs. that XY; if you see some differences in behavior between the genders, does that reflect on genetics? Obviously the environment is different; let us use that same strategy. Let us get a setting where you have the identical environment, do you see differences in behavior by gender, and a number of years back there was a highly influential study that recorded to show that and it was whopping of a finding that got all over the place in media and this was a study looking at some very precocious kids at mathematics, some junior high school kids who are already up in the league of

taking the teens, there were some major math whiz kids and looking at this whole bunch and looking at their math performances as a function of gender (Catsambis 227). The massive sample size and what it was wound up seeing is that there were a whole lot more boys performing at the very highest levels of math than girls. Interestingly there were also more boys performing at the lowest level of math and on the average, the mean right in the middle was that boys were doing better than girls. What you have now witnessed, the paper concluded was in so far as these kids were in identical environment, if you see this difference in math, the long recognized difference in math skills were on the average, this sort of highest echelons of mathematics is invariably filled disproportionately with males who we have just shown a genetic component.

Why do these authors argue that there was an identical environment because it is not until high school that you get to choose or you taking calculus and stuff like that? At junior high, everybody is still tracking the same classes, these kids have gotten the same mathematics environment and if despite that equivalent environment you are seeing a gender difference, well round up those X and Y chromosomes we have just isolated something that has to do with them. In this particular study, which was extremely carefully done by the authors yet made this one assumption wound up having tremendous influence in the press and which had tremendous influence amongst teachers and parents and guidance counselors and what the gigantic assumption here of course was that you are raised in identical environments and what an enormous literature already shows is virtually starting from day one at school for the same exact answer in the realm of the Math question, boys are more likely to be praised by teachers than are girls already by junior high school for the same exact level of mathematics performance. Girls are already underestimated how good they are at math, there is no way you are dealing with a bunch of 12 year old kids who differ by gender who just happen to have been in the identical environment all their lives, we see a problem there with this approach.

Another version of how this is thought about is another one of those identical environments, different genes, and different behaviors. So we must be seeing something with the genetic influence and this is a fascinating literature, looking at ethnic differences in behavior and this is, as you might imagine, a very contentious area and this is one that for example, one has looked at child development as a function of ethnicity and there is a literature out there showing for example, that Asian-American children and European-American children differ like on their first day of life in their levels of activity. That is interesting and the author is not going to tell you what direction the finding goes, because that is irrelevant. The main thing is that within a day of birth, on the average whatever kids are already more active than whichever kids and in the similar realm in a day of life, infant boys are to be more active than infant girls. They have had only 24 hours to soak up environment; there is not a whole lot of environment going on there.

And what the studies also show is within minutes depending on the gender of your child, mothers are already interacting differently with the babies. Classic studies were used: tell the mother initially a different gender of a child but already you are seeing that by gender, babies are being treated differently within moments of birth and what they also show is within the first day of life, the parenting style, the extent to which you hold the child even the degree of movements and such are differing in those ethnicities once again an assumption that environments starts right at birth and can be controlled completely. So you can have an identical environment very shaky. We see some of the findings that come out of this approach but we see some of pitfalls there also.

Nature vs. Nurture: Debate Continues

Another approach taken by behavior geneticists and this is one that has a similar sort of logic exploited in a somewhat different way. This time you have individuals who share some genes and in this case you get completely different environments. So you have individuals who share genes and if they are raised in completely different environments and despite these totally different environments they still do the same exact behavior. Aha you have just uncovered yet again another area where genes have an influence and you can probably once again see what the assumption is there that can get into trouble, which is the notion of completely different environments. Let us see some examples,

back to that whole notion that you can control an environment entirely, there is a whole approach which was the backbone of one of the classic studies in behavioral genetics, extremely important study likewise in the history of psychiatry, one that pioneered an entirely new approach to the issue of- is there inheritable or genetic component to behavior. And this was pioneered by Harvard neuroscientists Seymour S Kety, one of the giants of the field who thought of this approach and this has been sort of bread and butter approach in that field every since and it is a tough one to do.

Here is the basic logic of what you look at; you look at kids who have been adopted. So they have been raised by non-biological parents and in the perfect version of this what you do, is take a kid very shortly after birth and so there is minimal environment shared with the parent, shared with the mother and they are adopted away and thus you can separate out (Kety 19). All they have gotten from their biological parents are genes, they got no environment from them and all they have got from their adopted parents is environment, no genes. You see the logic of how this runs. And what Kety did was this massive study which wound up being the first one to show what everyone considered to be irrefutable evidence for a genetic component to a psychiatric disorder. Now, you have not been able to find a population study that easily. Kety's insight among other things was to find the perfect population. It turns out Scandinavian countries have had obsessively good records of adoption going back forever, enormously detailed adoption records so that you controllably track down who the biological parents were (Cardno and McGuffin 35). An approach to confidentiality of information is different in some ways in the United States. What Kety and crew did was march off to Denmark and spend quite a few years there, going through every single adoption case there, getting a hold of the adopted individual there, the adopted parents, the biological parents and asking a simple question, one very relevant to psychiatrist who among the three adopted kids, adopted parents, biological parents is schizophrenic (Healy 196). And what they wound up seeing and this was a small team of psychiatrist they have been doing all of the checking. There was a lot of reliability, there was not a 400 different psychiatrists coming back with their reports, there was not division of labor. It was the same psychiatrists doing all the interviewing and all the testing and they came back with a very interesting classic finding. We have got four possible outcomes: a. you were raised in a non-schizophrenic household and your biological parents were not schizophrenic; b. raised in a schizophrenic household, biological households were converts; c. raised in a non-schizophrenic household with biological schizophrenic parents or d. double whammy biological parents with history of schizophrenia adopts the parents history as well.

Here is what they saw, first scenario. Raised in a household where neither adopted parent is schizophrenic and neither biological parent was schizophrenic. The chance of schizophrenia in this population that they study is one percent incident. And that is roughly what you see in the general population. Now let us raise the kid in a schizophrenic environment one of the adopted parents is schizophrenic, neither biological parent is. And what you notice is 3% chance of schizophrenia. Three-fold increase in with this sample is a huge population; this was a very reliable difference. Being raised in a schizophrenic household approximately triples your chance of disease.

Now the critical one, kids raised in a non-schizophrenic household adopted parents, no evidence of schizophrenia; however the biological parents, one of them had schizophrenia. Remember the biological parents with whom you got no environment, all you got was genes, what is the chance of schizophrenia – 9 %. Almost a tenfold increase and for everyone this settled it, this was the proof of a genetic component to psychiatric disorder, the clearest evidence that you can get. Finally just as interestingly you get this scenario of biological legacy of schizophrenia, adoptive household pattern of schizophrenia and a 16% chance. Notice 16 is more than the difference between one percent and three percent plus one percent, nine percent you get this synergy going on.

Everybody loved this, this was just a pioneering groundbreaking approach and people since then have done adoption studies looking at incidences of depression, of anxiety disorders, alcoholism and what they very frequently show is a genetic component, a contribution where when you have got absolutely nothing from your biological parents other than genes and are put into a totally different environment, that is the way to tell if there is a genetic component. And by now you should be able to see what the

confound is in that approach, which is the notion that you get put into an entirely different environment; that there is no shared environment between the world of the biological parents and the world of adopted parents.

All you need to do to appreciate that is look at adoption records and in the United States there are definitely patterns where children are often placed; adopted agencies try to place children with parents of the same race, the same ethnicity, things of that. You are actively selecting for shared environment, the notion that you have this child is being adopted and you sit there and you close your eye and you spin the globe and as long as you don't land in the middle of the ocean or wherever they land because that is where they are going to be adopted to you randomizing adoption. Anything but that is not a randomly different environment. There is, it turns out a lot of shared environment often quite intentionally between the biological parents and the adoptive parents. So that is a problem; that environment is somewhat overlapping- the assumption that if you were adopted away at birth, if you were adopted two seconds after you were born that you have shared no environment with your biological parent is completely wrong because the fetal environment is very much shared with your mother.

Twinning: Two Faces of the Same Coin

Now we go to what is considered the gold standard amongst these folks which is to get to individuals who are genetically identical and are raised in completely different environments. That is a study one can do on a lab rat very easily as soon as it is a litter of identical animals are born, you raise them with different mothers who foster them up. What is the human equivalent of identical twins who are adopted away to different settings, this is the whole world of identical twins separated at birth and if you were behavior geneticists you will gladly stab your competitor for the chance to get a hold of identical twin separated at birth. Everybody loves these guys, what could be better than this. And there is a whole literature that has grown up about these guys by now and we are just like these perfectly dramatic differences and recalling them were some shares where they were adopted shortly after birth. For example, one of them wound up at orthodox Jewish household and the other one would up at some neo Nazi family and at age 40 they bring in together and it turns out both of them like the same food item. From there, that sort of stuff you could begin to infer identical genes, totally different environment, yet shared behavior. So we have got to be seeing some sort of genetic thing going on here. And the whole identical twin thing separated at birth is a very powerful paradigm. Once again with the confound of just how different are environments nonetheless this approach has given all sorts of hints of aspects of heritability that genetic influences on behavior and these have mostly fallen into three realms like three areas that set all sorts of red flags.

First one is performance IQ test and we know amply by now that performance on the IQ test does not equal intelligence, multiple intelligence, social intelligence, things not tested for cultural biases. Forget intelligence, even now when you perform on IQ test that is one heck of a label you can get in lots of societies. So estimates from these identical twins separated at birth here is a non-trivial heritability to IQ performance. Next one is introversion and extroversion. One of the most stable features of personality out there in study usually show is one year old is introverted are reactive to novel environment are at more than chance likely to grow up to be introverted adults, extroversion likewise seems to be a very stable personality trait. Interestingly with all sorts of disease implications, certain diseases like extroverts vs. introverts differ in their propensity and what the created birth study show are some non-trivial degree of heritability there. The third area and this is one that is real relevant is the degree of aggression (Brown 80). That is kind of interesting too, this approach suggesting that take two individuals who are genetically identical, separate them at birth and 40 years later bring them back into your lab and they may have all sorts of behaviors in common. Those behaviors have to have some genetic components and this was summarized in the classic perfect cartoon by Charles Adams who had found the Adam's family in cartoon in new Yorkers and it shows that two guys and they are sitting in art chairs and what is clearly a waiting office and you can see there at the door at the waiting office that backwards class there and it says something like patent office and these two guys are sitting there and they are both dressed identically and they are both

wearing like hip waiters and bizarre waters and weird plastic clips on their shirt and they look the same and in their laps are sitting both identical, these two bizarre little gizmo machine for no obvious purpose and the two of them have invented these identical machines and have shown up identically dressed at patent office with the legend at the bottom the Mallifert twins separated at birth meet by chance (Heyman 93). And this was the notion of this twin separated at birth, identical twins you see a similarity there and you are looking at genetics.

Conclusion

So what are the caveats that we have got by now. Ok if you find something genetic, does that mean that genes are determining. Not a chance. Most of what goes on with genes is regulation genes, or environmental genes are not sitting there with the blueprint running the whole thing. So when we have uncovered the whole thing in genetic, we are not talking determinism, we are talking utter intertwining with the environment. What is the next thing we have figured out the backbone of all these studies is the notion that you can get two individuals raised in very different environments and what we have seen there is that very frequently a problem. Environments can be similar in all sorts of subtle ways and settings where people are raised in identical environments they can differ dramatically as well. The other assumption that runs through all these studies is one that was sort of intrinsic to the adoption studies whether of identical twins or the Kety style approach of looking adoption and marking schizophrenia which is this notion that has been said before that you have somebody who has given birth and two seconds after the woman gives birth, the child is adopted elsewhere, thus all the child has gotten from the mother are genes. All that is shared are genes, 50% sharing, there is no shared environment. And the problem with that is that environment does not begin at birth. If one is a human then one has already spent 9 months sharing a very intimate environment the circulatory system with one's mother. Hence, even prenatal environment can influence behaviour in all sorts of ways. Hence the debate continues and there is hardly any conclusive proof for either genes or environment acting as the prime moving force in terms of human personality.

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