Is the new genomics reconfiguring kinship and family?

Peter Taylor, 17 March 2011

0. Preliminaries

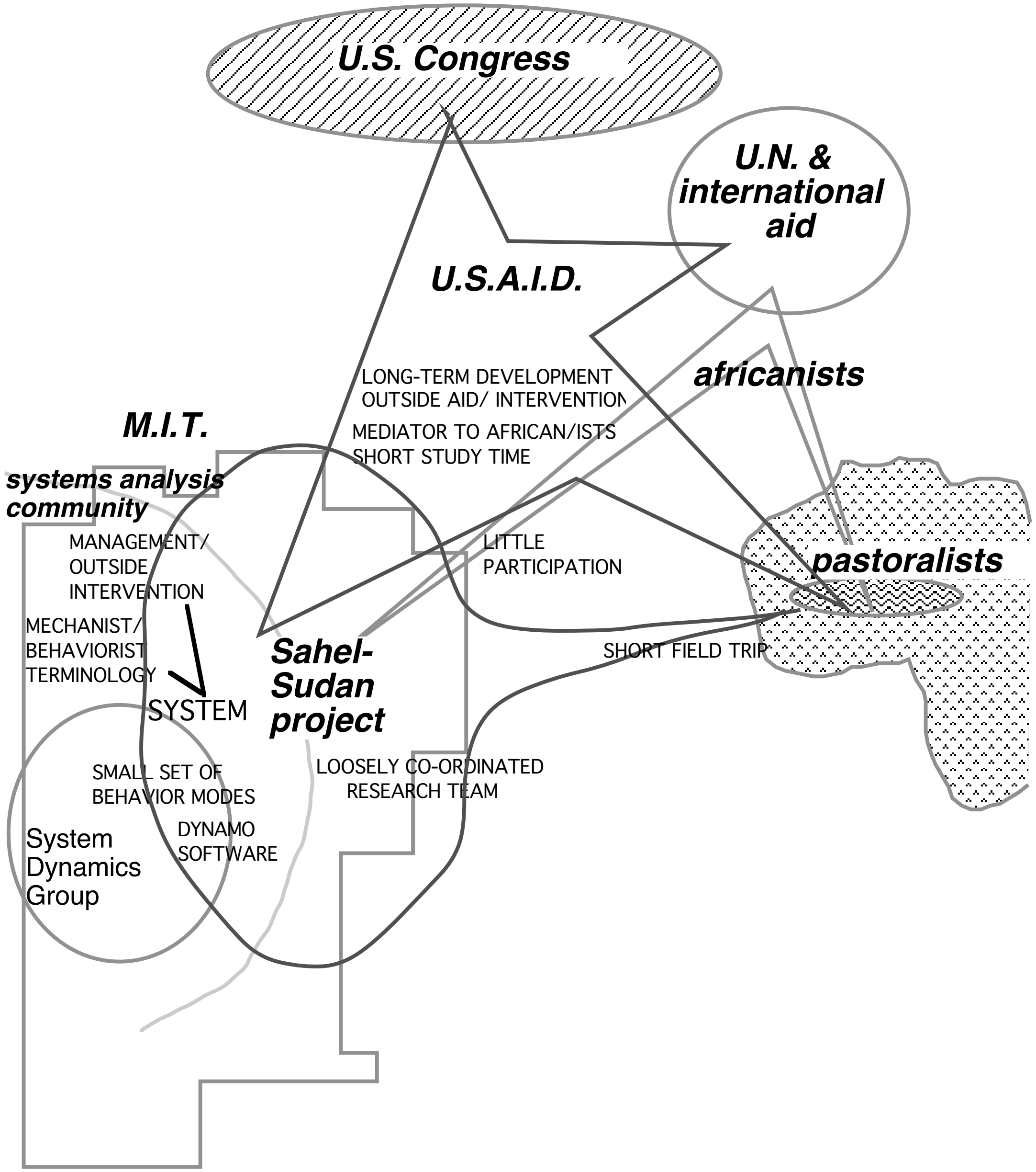
Science <-> Interpretation <-> Engagement

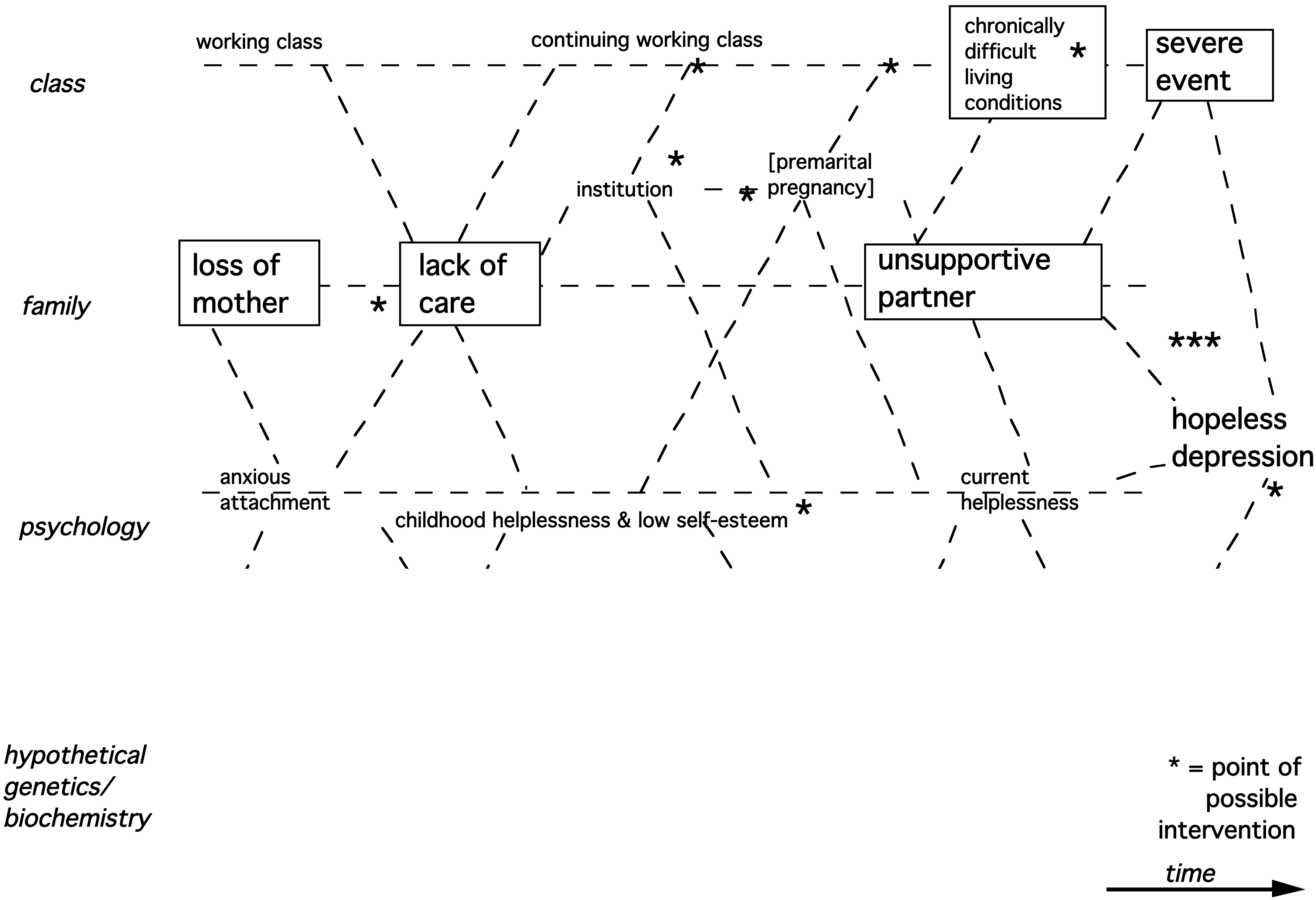
Reciprocal animation
Close examination of conceptual developments within the sciences can lead to STS questions about the social influences shaping scientists' work or its application, which, in turn, can lead to new questions and awareness of alternative approaches in those sciences.

Heterogeneous construction
"Construction" here connotes:

- many diverse elements linked together over time (intersecting processes) ->
- things have multiple contributing causes ->
- there are multiple points of engagement =

points at which the courses of construction could be changed.


U.S. Congress
U.N. &
international
aid
U.S.A.I.D.
africanists
LONG-TERM DEVELOPMENT
OUTSIDE AID/ INTERVENTION
M.I.T.
MEDIATOR TO AFRICAN/ISTS
SHORT STUDY TIME
systems analysis
community
MANAGEMENT/
OUTSIDE
INTERVENTION
LITTLE
PARTICIPATION
pastoralists
MECHANIST/
BEHAVIORIST
TERMINOLOGY
SHORT FIELD TRIP
Sahel-
Sudan
project
SYSTEM
SMALL SET OF
BEHAVIOR MODES
LOOSELY CO-ORDINATED
RESEARCH TEAM
DYNAMO
SOFTWARE
System
Dynamics
Group



class
family
psychology
hypothetical
genetics/
biochemistry
working class
continuing working class
chronically
difficult
living
conditions
severe
event
institution
[premarital
pregnancy]
loss of
mother
lack of
care
unsupportive
partner
***
hopeless
depression
anxious
attachment
childhood helplessness & low self-esteem
current
helplessness
* = point of
possible
intervention
time

1. Science

Underlying heterogeneity is a significant un(der)acknowledged issue in genetics and genomics

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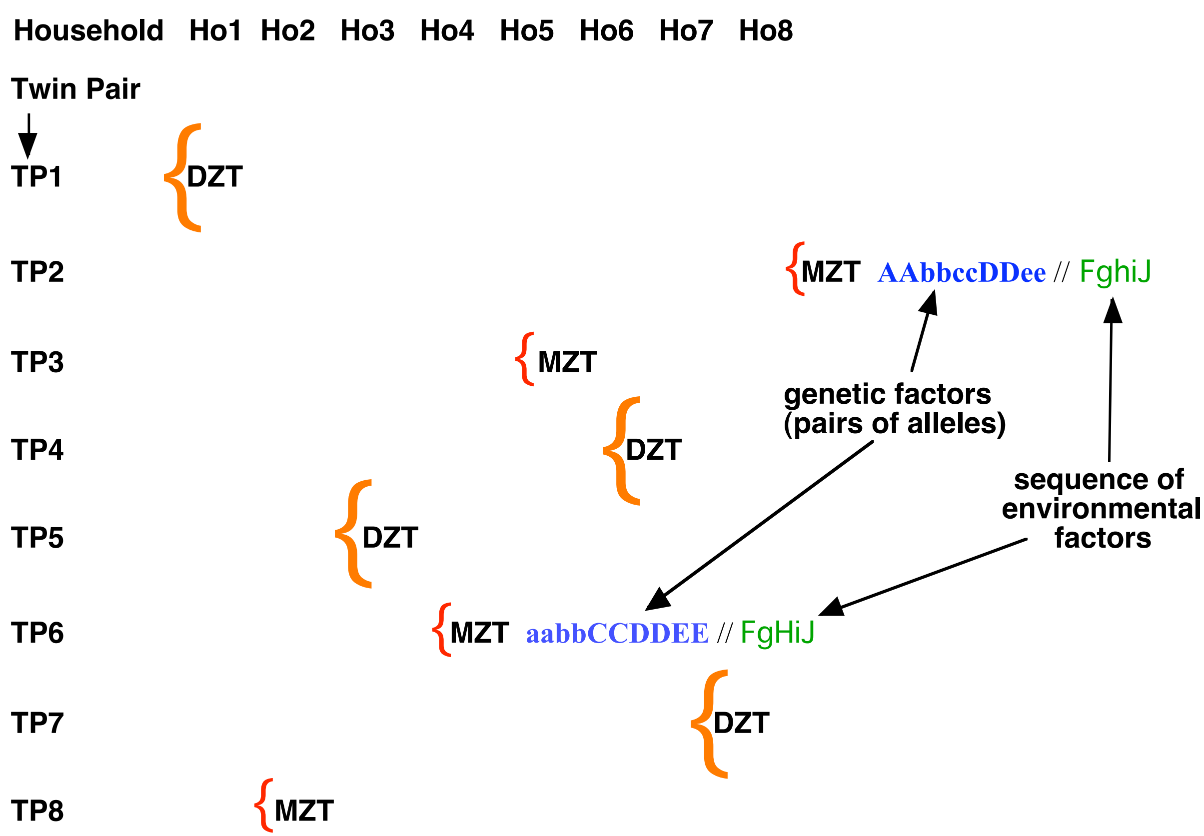
Household / Twin Pair	Ho1	Ho2	Ho3	Ho4	Ho5	Ho6	Ho7	Ho8
TP1	DZT							
TP2								MZT
TP3					MZT			
TP4						DZT		
TP5			DZT					
TP6				MZT				
TP7							DZT	
TP8		MZT						

1. Science

Underlying heterogeneity is a significant un(der)acknowledged issue in genetics and genomics



2. STS interpretive inquiries

a. historical

b. submission for publication as a probe into social dynamics of science

c. conflation of family and population -- see http://wp.me/pPWGi-1w, "The conflation of family and population helps explain why the Nature vs. Nurture formulation persists"

-> d. historical again, review early eugenics

3. Engagements

Participatory postscripts in a new book project, *Troubled by Heterogeneity?*

e.g.,

> *Another blog will juxtapose two kinds of entries: a. Stories shared by family members, care-givers, and other actors—including STS researchers—that amplify the PKU picture of diverse influences shaping pathways of development over the life course for those with distinct genetic conditions (Rapp 1988, Rapp et al. 2002, Ginsburg and Rapp 2002); b. Claims that molecular biology and biotechnology will allow genetic information to reshape human life. Readers would be invited to contribute entries of both kinds as well as to make comments contrasting the claims with infrastructure-building measures (including measures sometimes taken by the same researcher making the claims).*

Many people say Nature vs. Nurture is an ill-framed formulation, but the challenge is to explain why in a way that accounts for the persistent popularity of that formulation.

We know, for example, that both genes and environment are involved even in the cases in which there is a single gene with a major and direct effect, such as phenylketonuria (PKU). In PKU the development of individuals having two copies of a non-functioning allele for the enzyme phenylalanine hydroxylase (PAH) is extremely impaired by the level of phenylalanine present in normal diets, but much much less impaired if a special diet is maintained. OK, but one might say that genes are primary here: Without the genetic condition, we don't need to worry about the diet (the environment). Knowing the genetics, or at least, the biochemistry associated with the genetic condition, points to the appropriate environment to alter. In fact, all kinds of changes in upbringing of individuals with the genetic condition would have no effect. In short, nature interacts with nurture, but it's most important to know about the genetics and biochemistry. And, if that's the case for PKU, you might well suspect that there are many other genes, perhaps of smaller and less direct effect, for which the same primacy would hold. And, why decide in advance that certain traits, such as IQ test scores, are not amenable to genetic study? The response sketched in this blog and follow-up installments is that the issue is more than primacy of genes as sketched above; there is a conflation of family and population involved in the persistence of the Nature vs. Nurture formulation.

Starting within a family, it's very easy for someone to see that children physically resemble their (birth) parents (where resemble means more than look like their parents—it is look more like their parents than any two people randomly picked from the population). In most cases parents pass onto their offspring environment as well as genes, so one might well ask how important is each? That's hard to say when parents pass on both so you imagine identical twins raised apart from birth and ask: Does the one raised at home resemble the parents more than the one raised away? But, of course, no offspring resembles both parents well—(generally) a child is male or female and lots of characteristics (e.g., height, hips) go along with that. So, perhaps you look at resemblance between offspring and same-sex parent for physical traits and between offspring and the average of the parents for other traits? That doesn't quite work for sexual characteristics. Conversely, the average of the parents might also capture resemblance for physical traits such as height. You simply expect there to be variation around that average, e.g., female offspring end up on the shorter side of the average and male offspring end up on the taller side.

Once you start talking about variation and averages, and stop expecting a clean picture of resemblance in any one family, you can shift your sense of resemblance from the family to averages over many offspring-parent pairs. Going back to the identical twins, if you imagine many such pairs of twins, on average does the one raised at home resemble the parents more than the one raised away? You could also ask, if you have many sets of same-sex non-identical twins raised together and many sets of same-sex identical twins raised together, on average do the does one identical twin resemble the other twin more than one non-identical twin resemble the other? (Shifting to same-sex twins means that we don't have the complication of differences between an offspring and its other-sex parent. And shifting to twins raised together means you don't have to search for the rare cases of twins separated and raised in truly independent families.) If the answer in the twin-resemblance study is yes, it seems reasonable to conclude that the identical twins are on average more similar because they share all their genes whereas the non-identical twins share fewer of their genes. However, that conclusion doesn't say that it's the same nature—the same genes—or the same nurture that brings about the resemblance from one pair of twins to the next. So then where are you? Stay tuned for the next installment.

The first installment ended on the following note: Suppose you have many sets of same-sex non-identical twins raised together and many sets of same-sex identical twins raised together and find that the identical twins are on average more similar. It seems reasonable to conclude that is because they share all their genes whereas the non-identical twins share fewer of their genes. However, that conclusion doesn't say that it's the same nature—the same genes—or the same nurture that brings about the resemblance from one pair of twins to the next. Given this possibility of underlying heterogeneity where are you? What can you do?

You might take the results of the multiple twins study and transfer them back into thinking about your family. Suppose that the non-identical twins are very much less similar so that sharing fewer genes makes a big difference (skipping here the technicalities of getting the number, "heritability," that quantifies that result). If that is so, you might say: "There's nothing I could do as a parent to change the outcome for my offspring (for whatever trait you're thinking about, e.g., IQ test score). I'm not to blame for the outcome (other than having passed on my genes). If that seems justified to you, you might then reason that the same is true for every other family, and thus society as a whole shouldn't try to change what it's doing for it won't make a difference.

Now flip that scenario. Suppose that the non-identical twins are just as similar so that sharing fewer genes makes little difference. What can you do as a parent? Or, if your offspring are grown, what could you have done?—What then can you advise others for the future, or society at large? In this scenario, the possibility of underlying heterogeneity is a problem. Your study of twins has not shown you what environmental factors have had an effect so you don't know what to change. And, if you can't expect the factors to be the same from one family to the next, you might just give up on trying to identify those factors.

Notice an asymmetry in these scenarios. The possibility of underlying heterogeneity didn't lead you to give up on looking for the genetic factors because your reasoning did not lead you to look for them at all. You simply concluded that you weren't to blame for the outcome in your family and, by extrapolation, society shouldn't try to change what it's doing.

Now there's a problem in the reasoning that says because sharing fewer genes makes a big difference there's nothing a parent can do to make a difference. Any set of twins, call it set i, is raised together in family i—each nature i has a nurture i. There are lots of i's. There is nothing in the average over many sets of nature i – nurture i pairs that says there cannot be a nurture j or k or l in which nature i in nurture j or k or l wouldn't be different in interesting ways. Perhaps if you found that identical twins raised apart were just as similar on average as identical twins raised together, you'd doubt that such a nurture j or k or l could be found. You'd doubt, but not be sure. You could be surprised. Japanese offspring after WWII grew taller on average than their parents, but a comparison of twins in the previous generation woud have shown that sharing fewer genes makes a big difference (i.e., heritability for height was high).

Once you entertain the possibility that nature i varies across nurture i, j, k, l, ... you can ask about what genetic factors and what environmental factors are involved and how they act together. Now there is a symmetry in how difficult it is to identify those factors if you cannot expect them to be common across families. Some responses to this difficulty are taken up in the next installment.