WORKING PAPER on Science in a Changing World

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The Social Construction of Life

Critical Thinking about Biology in Society

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Introduction

"The Social Construction of Life." What does this title mean to you? Take a minute and jot down your thoughts.
While you do this, here is a non-distracting graphic.

What was your response to being asked this at the outset? What did you feel? Think? Do? Take another minute and explore your responses? Be honest.

Another non-distracting graphic.

Probably most of you just looked ahead to see what point I intended to make by starting with these questions. I could make you wait if this were a lecture you were listening to. If you were students, I could have used my authority as a teacher to get you to write down something. But this is a book so I cannot enforce readers' compliance with my directions. Let me then move on and explain the meaning and associations I attach to key terms, then provide an overview of the themes that unfold over the chapters. But first, note that:

- I value people not accepting anything without questioning.
- I am also prepared for you, the readers, to feel disturbed or even anxious, unsure of what constitutes the expected response.
- I want to open for your questioning many issues which you might have taken to be well established or which you would previously have waited for someone else to provide complete and tidy answers for.

Overview of Themes and Terms

This book aims to expand the boundaries of the influences that readers consider when interpreting the practices and products of the life sciences ("biology") and their impact on society. In this spirit, "science" is not just a knowledge-generating dialogue between theory and reality, but

- an outlet for curiosity
- a body of accepted knowledge
- a process of establishing knowledge

- what scientists do
- institutions (laboratories, professional associations, funding agencies, journals, etc.)
- a source of social authority
- a producer of social impacts.

At each level social action is occurring, which involves

- the use of language
- making one's life and work in a particular time and place, and from a (possibly changing) social position
- economic relations
- political conflict and negotiation.

Given this diversity of social considerations, the relations between biology and society is constructed, in the sense both of

- a building which is made of many different materials, and
- an interpretation drawing upon precedents and established assumptions.

Moreover, this social construction of life connects not only the life sciences, but also

- living processes
- groups of people's lives and livelihood
- the reader's own life.

When I define critical thinking I point to inquiry that is informed by a strong sense of how things could be otherwise. I believe that people understand things better when they have placed established assumptions, themes, facts, theories, practices, and social relations in tension with alternatives. [C]ritical thinking as I define it does not depend on my readers rejecting conventional accounts and adopting some alternative dogma. It does, however, require you to move through places of uncertainty. This book destabilizes established approaches, raises many propositions well in advance of demonstrating them, and invites you to use the propositions in your own thinking and writing—to experiment, take risks, and through experience develop tools that work for you.

In the spirit of critical thinking, we can place in tension the idea that something is constructed with the idea that it is determined. In construction (in sense of building, not of interpretation):

- Many different kinds of components are linked together over time, each step building on what has already been constructed. This implies that:
- The outcome has multiple contributing causes, and thus:
- There are multiple points of intervention or engagement that could modify the course of development.

In contrast, when something is determined:

- The links between proposed causes and outcome are direct, e.g., severe depression is a biochemical imbalance.
- Few steps are involved in the causation and a single kind or small number of causes dominate.
- Few opportunities arise for things to have happened differently, in particular, social policy will not be able to change the outcome greatly.

Interpreting Ideas of Nature

Broad-brush themes:

- What is said or written, instead of being taken literally, can be interpreted so as to expose what is only implicit.
- In the spirit of critical thinking, consider the contrast between, on one hand, "When I hear people say, 'Nature tells us..' I hear them telling me their views about the way they want people/society to do things" and, on the other hand, "I still think it is important to know what is natural and what is unnatural. Otherwise anything is acceptable."
- Interpretation of ideas of nature (following Williams 1980): They are often invoked to justify aspects of the social order, usually aspects becoming problematic at that particular historical juncture, or proposed alternatives to the social order. So, when we hear people debating what nature is or what is natural, we can ask ourselves what it is about society that is being debated.

The structure of origin stories

Interpret story-telling, focusing on origin stories both outside science and inside.

- Story tellers select elements and arrange them in a sequence. Selection and arrangement simplify the complexity of influences needing to be considered to understand the outcome and cover over the uncertain or unknowable information. The story-teller not only gives emphasis or credence to the outcome, but can also try to make plausible the causality implied in the story.

- Stories are more compelling if they adopt a familiar structure and if they resonate with other stories.
- The influence of structural (or structuring) themes can be seen by identifying them and asking what would happen to the account if an opposing or alternative theme were employed.
- Playing one theme off against another and creating some interpretive tension is an example of critical thinking in the sense of understanding ideas or practice better by holding them in tension with alternatives.

- Origin stories are important because they are used to make sense of and often to justify the state of affairs we find ourselves in now.
- Many scientific accounts can be read as stories or narratives (Landau as described in Lewin), especially when
  1. they attempt to deal with uncertain or unknowable information, e.g., in accounts of origins—meaning both the point of origin and the subsequent history—and evolution; or
  2. with many connections and causes rather than a few experimentally controlled factors.

Multiple layers in influencing an audience: The case of Darwin's On the Origin of Species

Having been sensitized to the story telling aspect of scientific writing, to the dominant structural themes adopted in accounts or origins, and to the ideas of nature that were invoked before Darwin to support ideas of the social order (whether that was the actual, idealised, or desired order), we are now in a better position to read Darwin and interpret his ideas on evolution and on the means by which it occurs.

- Williams's account of the history of ideas of nature conveys a general trend: Ever increasing interaction of societies with/in nature -> idea that nature has a history -> evolutionary theories of nature -> contested issue: do humans evolve too?
- Darwin's specific contribution: The idea that everything in nature is adapted to its place, but that this is the result of an on-going struggle for existence, not given by creation once and for all.
- Broad-brush interpretation of Darwin's idea about how evolution happens: The idea of evolution by natural selection relates to and supports a dominant idea about social order, namely, that one's place in society is a result of a natural process of selection, and, given that the result is adapted, this is right/ justifiable/ as good as we could hope for.
- Such an interpretation raises a question: What did Darwin actually *do* in his scientific research that resulted in a theory that fits that social interpretation?
  Answer: To influence his audience in 1859 England, he carefully built up multiple layers in his scientific theory: argument, analogy, metaphor, and defences.

Metaphors of Coordination and Development

- Until the 1920s, biological inheritance had much broader connotations than transmission of something discrete (which we now call genes). It also included development. After all, when it is said that a person resembles their parent, two aspects of the transmission of traits to offspring are being raised: how does an offspring develop to have the trait in question at all, e.g., its eye color, and how does the outcome of the development at some point in the lifespan differ from that person to the rest of the family or population. What, then is the relationship between the study of development and the study of difference? What is the role of genes in both? Competing answers to these questions are

evident in the contrast between the work of Just and Goldschmidt in the early decades of the twentieth century.

- Interpreting the work of Darwin has introduced the role of metaphor in scientific theories and their presentation to an audience. The account by Gilbert of Just versus Goldschmidt revolves around his interpretation of the metaphors underlying their work.
- Extend this to the present: Explore alternative metaphors of or analogies to embryological development that do not rely on a central controller but capture the ability of the organism to co-ordinate its own differentiation and change and thereby make itself.

What causes a disease?—the consequences of hereditarianism in the case of pellagra

- The causes proposed reflect the social actions desired or supported given that
  - the categories used (and thus data collected)
  - assumptions needed to make causal claims from patterns
    - are places where social assumptions can influence the scientist's decision, and
    - science cannot be done without decisions in these areas
- When people make explanations, you may look at how they attempted to identify or locate the causation and consider alternative styles of causal explanation. If a scientist is emphasizing, say, a unitary cause, consider the multiple factors they are excluding.
- This approach will help you raise questions about the other commitments that influence their choice of questions, categories, factors, and admissable explanations. The causal explanation that is advanced often corresponds to the person's commitments to certain forms of social action, e.g. Galton (Darwin's cousin) didn't measure any environmental variables and was thus able only to reach conclusions about (supposedly) inborn characters; Davenport and others similarly denied the significance of Goldberger's experimental evidence for dietary basis of pellagra.
- Identification of more proximate causes (e.g., a lung cancer gene) is not necessarily needed to ensure the most effective action (e.g., we can encourage people to stop smoking independently of knowing the genetic mechanisms of lung cancer).

How changeable are IQ test scores?

- A continuation of the critical thinking theme of interpreting scientific ideas in relation to the actions favored by the exponents of those ideas is to pose questions that can be asked of all sides: What can we do (on the basis of the science)? What more would we need to find out before being confident in answering the first question?
- By unpacking the debate between Lewontin and Jensen, the following themes should emerge:
  - There are no simple explanation about genetics and socially significant traits, especially regarding average racial differences. Therefore: be skeptical of anyone who proposes such an explanation (i.e., scrutinize where they are coming from).

- There are researchers who have detailed, often technical cases to make (even if their conclusion is quite simple, e.g., Jensen believes it is plausible that genes account for (average) racial differences). Their argument can be teased out into their components (in this case, with help from Lewontin, who can handle the technical side and has views about the political/social implications and underpinnings of the science).
- What can we do (on the basis of the science) is worth asking of all sides. (Jensen thinks we have tried and failed to equalize education so educate people according to their innate capacities [actually, educate people according to the typological generalization about the average differences between the races]; Lewontin thinks educational professionals have not tried very hard and when society is committed to equalizing education ways will be found.)

Social negotiations around genetic screening

- The debate about the changeability of IQ test scores (Jensen vs. Lewontin) referred to the heritability of IQ test scores, but no actual genes. It also referred to the limitations and possibilities of education, but did not focus on specific educational projects—how they succeeded or failed and in what circumstances. In contrast, this session examines how specific groups (or "voices") in society shape or are involved in the application of knowledge about specific genes.
- Rapp draws our attention to many constituencies and voices in the arena or reproductive interventions, in contrast to the dominance of white, male experts and a medical model: "Until we locate and listen to the discourses of women who encounter and interpret a new reproductive technology in their own lives, we cannot go beyond a medical model." Medical model = individual risks, benefits and choices (aided by dominant metaphors of human perfectibility and individuals holding within them their potential) vs. situated, social responses, e.g. social support for the disabled, Down Syndrome support groups.
- In the case of phenylketonuria (PKU), Paul (1998) shows that significant complexities should be expected to arise if neonatal genetic diagnosis and advice about risks and about possible protective measures become widespread. Moreover, just as there are many voices that could be listened to in understanding how to use new genetic information, there are diverse influences to which PKU individuals are subject on their pathways of development over their life course.

Intersecting processes involving genes and environment

- This chapter extends perspectives from the previous two—the debate about the changeability of IQ test scores and the possible involvement of multiple voices in the application of knowledge about specific genes—by tracing "intersecting processes"—the sequence of multiple causes building on each other over the individual's life history. This account of causality permits a number of conclusions about nature-nurture debates:

- Neither the unchangeability of genes nor the reliability of some gene- or biochemistry-based intervention would prove that the genes are the most significant cause of the behavior or disease that has been occurring in the absence of such treatment.
- Critics of genetic explanations could dismiss the attribution of an individual's behavior to genes (or 50% or 80% to genes) as a technically meaningless partitioning of variation without placing themselves at the other pole from genetic determination. That is, they would not have to make the counterclaim that the environment determines behavior or that, if the right environment were found, any desired behavior could be elicited. An intersecting processes account addresses malleability or immalleability of behavioral outcomes without ruling out genetic contributions.
- Similarly, critics would not need to rest their case on demonstrations that behavioral genetics has been or still is methodologically flawed, on textual deconstructions of the categories and rhetoric employed, or on attributions of political bias to the supporters of behavioral geneticists. These are all interesting, but, in light of an intersecting processes account of the behavior, not necessary for a conceptual critique of genetic determinism.
- There are multiple points of intervention or engagement that could modify the course of development.

Looking back; looking forward

The introduction stated that social action involves the use of language, making one's life and work in a particular time and place, and from a (possibly changing) social position, economic relations, and political conflict and negotiation. The chapters have emphasized the first two features. However, in the illustrations of intersecting processes—the social origins of depression in a population of working-class women and soil erosion in Oaxaca—economics and politics are evident. Future chapters that may be added would give more explicit attention to the contribution of economic relations and political conflict and negotiation to the social construction of life.

Structure of chapters

1. Introduce simple theme(s), building on previous sessions
1b. amplified by mini-lecture (which might include interactive activity)

2. Precis of reading with directions about reading the full work

3. Activity so students can work with simple theme, but then
3b. see its shortcomings

4. Synthesis and extensions: notes summarizing themes in more complex formulation
4b. including notes on pedagogical issues

5. Connections and resources, e.g., annotations to additional readings
5b. Online forum, through which students can provide suggestions and resources for revising the chapter
5c. Adaptation of themes from the chapter to students' own projects of learning about or engaging with biology in its social context: Suggestions for how to do that.

Boxes (or exhibits) referred to (i.e., linked in the online version) in a chapter follow at the end of the five sections.

Interpreting ideas about nature as ideas about society

1. Introduction

The book progressively develops a framework for interpreting biology in its social context, starting with the broad-brush themes of this chapter:

- What is said or written, instead of being taken literally, can be interpreted so as to expose what is only implicit.
- In the spirit of critical thinking, consider the contrast between, on one hand, "When I hear people say, 'Nature tells us..' I hear them telling me their views about the way they want people/society to do things" and, on the other hand, "I still think it is important to know what is natural and what is unnatural. Otherwise anything is acceptable."
- Interpretation of ideas of nature (following Williams 1980): They are often invoked to justify aspects of the social order, usually aspects becoming problematic at that particular historical juncture, or proposed alternatives to the social order. So, when we hear people debating what nature is or what is natural, we can ask ourselves what it is about society that is being debated.

1b. Mini-lecture

Interpreting a series of images from history, in order to introduce the framework of Williams (1980).

2. Reading

Raymond Williams (1926-89) was an English-Welsh writer about culture, literature, language, and politics, as well as a novelist. His essay, "Ideas of nature," gives us a sense of the changing meanings given to the term “nature,” the coexistence of contradictory meanings at any one time, and how these meanings reflect ideas about the social order being defended or promoted. There is a cycle: society is projected into nature and then propositions about society are read back out of this “nature.” Ideas of nature are often invoked to explain aspects of the social order, usually aspects becoming problematic at that particular historical juncture. So, when we hear people debating what nature is/what is natural, we can ask ourselves what it is about society that is being debated. In other words, we should try to expose what is only implicit, what is not literally stated.

Williams's essay is somewhat dense, so employ two reading strategies:

- Use a timeline to make notes as you go, with 2 narrow columns and a wider one for what is happening generally in society; the period or century; and the different ideas of nature aligned with the periods.
- After reading each section, write down the thesis or theme(s) and quotations that strike you as important or as puzzling.

Opening pages of Williams (1980; full essay available through password-protected page.)

3. Activities

- In small groups, students compare and contrast their timelines, important and puzzling themes, then choose one to bring into whole-group discussion.
- On their own, students continue the three-person discussion below. Then, in small groups again, students compare and contrast the "trialogues" and choose one contrast or conflict to bring into whole-group discussion.
- Students visit a natural history museum, conducting a "scavenger hunt" for exhibits that illustrate Williams's account and for exhibits that contradict or complicate his account.

Nature, a three-person conversation

Partovo ("Humans are a Part Of nature"): Humans are living organisms. As such they are part of nature. Therefore, everything they do is natural.

Separato ("Humans have become Separate from nature"): People have lost touch with nature and that is why our environment and our society are in trouble.

Interpreto ("Interpret Socially views about nature and what is natural"): When I hear people draw lessons from nature, I hear them really telling me something about their views on society.

Separato: You'll have to explain this interpretation to me, because, without a sense of what is natural and what is unnatural, anything is acceptable.

Interpreto: But Partovo has a sense of what is natural that tells him everything is acceptable.

Separato: Is that right?

Partovo: Yes.

Separato: So you mean mad cow disease, polio, AIDS, and so on are acceptable?

Partovo: Um, yes. We could look at them as forms of population control for the human species.

Separato: So you wouldn't invest in research for AIDS treatments?

Partovo: No. And I don't think the government should either. AIDS affects mostly gays and IV drug users. Their practices do not meet widely held community standards and so they don't deserve society's help.

Separato: I think you are out of date about who gets AIDS. But, putting that aside, I thought you said anything humans do is natural and thus acceptable.

Partovo: Well, not everything.

Separato: So, what is and what is not?

... (continued by reader)

4. Synthesis and extensions

- It is very easy to slip from interpreting "nature" (ideas about nature) back into discussion about un-interpreted nature as the actual material or living world, pointing to the importance of the latter as, for example, a source of ideas for new products (Venton 2011). This schema helps to keep nature and "nature" distinct and distinguishes between nature/"nature" as untouched by human activity vs. including human activity.
- Time line for Williams (1980)
- Extended trialogue (http://www.faculty.umb.edu/peter_taylor/naturetrialogue.html)
- There are many dualisms in our thinking in which a natural or universal characteristic is in opposition or tension with one that is cultural, artificial, or particular. The impact of such dualisms draws in part from the assumption that natural is the way things are supposed to be: Set of Nature-Culture dualisms.

5. Connections and resources

- Berger, J. (1980). "Why Look at Animals?". Pp. 1-26 in About Looking. New York: Pantheon Books
  annotation TBA
- Worster, D. (1977). "Science in Arcadia & The empire of reason". Pp. 2-55 in Nature's Economy. Cambridge: Cambridge University Press
  annotation TBA

5b. Add to this blog post to make contributions to the revision of the chapter above or to an annotated collection of readings and other resources related to the chapter.

5c. Adaptation of themes from the chapter to students' own projects of engaging others in learning or critical thinking about biology in its social context. Suggestions:
i. Locate a series of images related to your project and guide others in interpreting what is implicit.
ii. Identify texts related to your project in which nature or natural is used to support ideas about what is right or what is the way things should be or what is hard to overcome even if one wanted to.
iii. Get you audience involved in extending your own multi-person conversation that explores different views on a topic. Make sure you build in the idea that what is literally said is open to interpretation in terms of what is implied. Aim to expose and explore the tensions or contradictions in what people say.
iv. Brainstorm with instructor.

Interpreting a series of images from history, in order to introduce the framework of Williams
TBA insert thumbnails and captions

Ideas of Nature
From Williams, R. (1980). Problems in materialism and culture (pp. 67-85). London: Verso.

One touch of nature may make the whole world kin, but usually, when we say nature, do we mean to include ourselves? I know some people would say that the other kind of nature-trees, hills, brooks, animals-has a kindly effect. But I've noticed that they then often contrast it with the world of humans and their relationships.

I begin from this ordinary problem of meaning and reference because I want this inquiry to be active, and because I intend an emphasis when I say that the idea of nature contains, though often unnoticed, an extraordinary amount of human history. Like some other fundamental ideas which express mankind's vision of itself and its place in the world, 'nature' has a nominal continuity, over many centuries, but can be seen, in analysis, to be both complicated and changing, as other ideas and experiences change. I've previously attempted to analyse some comparable ideas, critically and historically. Among them were culture, society, individual, class, art, tragedy. But I'd better say at the outset that, difficult as all those ideas are, the idea of nature makes them seem comparatively simple. It has been central, over a very long period, to many different kinds of thought. Moreover it has some quite radical difficulties at the very first stages of its expression: difficulties which seem to me to persist.

Some people, when they see a word, think the first thing to do is to define it. Dictionaries are produced, and, with a show of authority no less confident because it is usually so limited in place and time, what is called a proper meaning is attached. But while it may be possible to do this, more or less satisfactorily, with certain simple names of things and effects, it is not only impossible but irrelevant in the case of more complicated ideas. What matters in them is not the proper meaning but the history and complexity of meanings: the conscious changes, or consciously different uses: and just as often those changes and differences which, masked by a nominal continuity, come to express radically different and often at first unnoticed changes in experience and history, I'd then better say at once that any reasonably complete analysis of these changes in the idea of nature would be very far beyond the scope of a lecture, but I want to try to indicate some of the main points, the general outlines, of such an analysis, and to see what effects these may have on some of our contemporary arguments and concerns.

The central point of the analysis can be expressed at once in the singular formation of the term. As I understand it, we have here a case of a definition of quality which becomes, through real usage, based on certain assumptions, a description of the world. Some of the early linguistic history is difficult to interpret, but we still have, as in the very early uses, these two very different bearings. I can perhaps illustrate them from a well-known passage in Burke:

> In a state of rude nature there is no such thing as a people.... The idea of a people is the idea of a corporation, It is wholly artificial; and made, like all other legal fictions, by common agreement. What the particular nature of that agreement was, is collected from the form into which the particular society has been cast.

Perhaps *rude,* there, makes some slight difference, but what is most striking is the coexistence of that common idea, a *state of nature,* with the almost unnoticed because so habitual use of *nature*

to indicate the inherent quality of the agreement. That sense of nature as the inherent and essential quality of any particular thing is, of course, much more than accidental. Indeed there is evidence that it is historically the earliest use. In Latin one would have said *natura rerum,* keeping nature to the essential quality and adding the definition of things. But then also in Latin *natura* came to be used on its own, to express the same general meaning: the essential constitution of the world. Many of the earliest speculations about nature seem to have been in this sense physical, but with the underlying assumption that in the course of the physical inquiries one was discovering the essential, inherent and indeed immutable laws of the world. The association and then the fusion of a name for the quality with a name for the things observed has a precise history. It is a central formation of idealist thought. What was being looked for in nature was an essential principle. The multiplicity of things, and of living processes, might then be mentally organized around a single essence or principle: a nature.

Now I would not want to deny, I would prefer to emphasize, that this singular abstraction was a major advance in consciousness. But I think we have got so used to it, in a nominal continuity over more than two millennia, that we may not always realize quite all that it commits us to. A singular name for the real multiplicity of things and living processes may be held, with an effort, to be neutral, but I am sure it is very often the case that it offers, from the beginning, a dominant kind of interpretation: idealist, metaphysical, or religious. And I think this is especially apparent if we look at its subsequent history. From many early cultures we have records of what we would now call nature spirits or nature gods: beings believed to embody or direct the wind or the sea or the forest or the moon. Under the weight of Christian interpretation we are accustomed to calling these gods or spirits pagan: diverse and variable manifestations before the revelation of the one true God. But just as in religion the moment of monotheism is a critical development, so, in human responses to the physical world, is the moment of a singular Nature.

Singular, Abstracted and Personified

When Nature herself, as people learnt to say, became a goddess, a divine Mother, we had something very different from the spirits of wind and sea and forest and moon. And it is all the more striking that this singular abstracted and often personified principle, based on responses to the physical world, had of course (if the expression may be allowed) a competitor, in the singular, abstracted and personified religious being: the monotheistic God. The history of that interaction is immense. In the orthodox western medieval world a general formula was arrived at, which preserved the singularity of both: God is the first absolute, but Nature is His minister and deputy. As in many other treaties, this relationship went on being controversial. There was a long argument, preceding the revival of systematic physical inquiry-what we would now call science-as to the propriety and then the mode of this inquiry into a minister, with the obvious question of whether the ultimate sovereignty was being infringed or shown insufficient respect. It is an old argument now, but it is interesting that when it was revived in the nineteenth century, in the arguments about evolution, even men who were prepared to dispense with the first singular principle-to dispense with the idea of God- usually retained and even emphasized that other and very comparable principle: the singular and abstracted, indeed still often and in some new ways personified, Nature.

Perhaps this does not puzzle others as much as it puzzles me. But I might mention at this stage one of its evident practical effects. In some serious argument, but even more in popular controversy and in various kinds of contemporary rhetoric, we continually come across propositions of the form 'Nature is. .. ', or 'Nature shows. . .', or 'Nature teaches. .. '. And what is usually apparent about what is then said is that it is selective, according to the speaker's general purpose. 'Nature is. . . ' -what? Red in tooth and claw; a ruthlessly competitive struggle for existence; an extraordinary interlocking system of mutual advantage; a paradigm of interdependence and cooperation.

And 'Nature is' any one of these things according to the processes we select: the food-chain, dramatized as the shark or the tiger; the jungle of plants competing for space and light and air; or the pollinator-the bee and the butterfly-or the symbiote and the parasite; even the scavenger, the population controller, the regulator of food supplies. In what is now seen so often as the physical crisis of our world many of us follow, with close attention, the latest reports from those who are observing and qualified to observe these particular processes and effects, these creatures and things and acts and consequences. And I am prepared to believe that one or other of the consequent generalizations may be more true than the rest, may be a better way of looking at the processes in which we also are involved and on which we can be said to depend. But I am bound to say I would feel in closer touch with the real situation if the observations, made with great skill and precision, were not so speedily gathered-I mean, of course, at the level of necessary generalization-into singular statements of essential, inherent and immutable characteristics; into principles of a singular nature. I have no competence to speak directly of any of these processes, but to put it as common experience: when I hear that nature is a ruthless competitive struggle I remember the butterfly, and when I hear that it is a system of ultimate mutual advantage I remember the cyclone. Intellectual armies may charge each other repeatedly with this or that selected example; but my own inclination is to ponder the effects of the idea they share: that of a singular and essential nature, with consistent and reconcilable laws. Indeed I find myself reflecting at this point on the full meaning of what I began by saying: that the idea of nature contains an extraordinary amount of human history. What is often being argued, it seems to me, in the idea of nature is the idea of man, and this not only generally, or in ultimate ways, but the idea of man in society, indeed the ideas of kinds of societies.

For the fact that nature was made singular and abstract, and was personified, has at least this convenience: that it allows us to look, with unusual clarity, at some quite fundamental interpretations of all our experience. Nature may indeed he a single thing or a force or a principle, but then what these are has a real history. I have already mentioned Nature the minister of God. To know Nature was to know God, although there was radical controversy about the means of knowing: whether by faith, by speculation, by right reason, or by physical inquiry and experiment. But Nature the minister or deputy was preceded and has been widely succeeded by Nature the absolute monarch. This is characteristic of certain phases of fatalism, in many cultures and periods. It is not that Nature is unknowable: as subjects we know our monarch. But his powers are so great, and their exercise at times so apparently capricious, that we make no pretensions to control….

Ideas of Nature

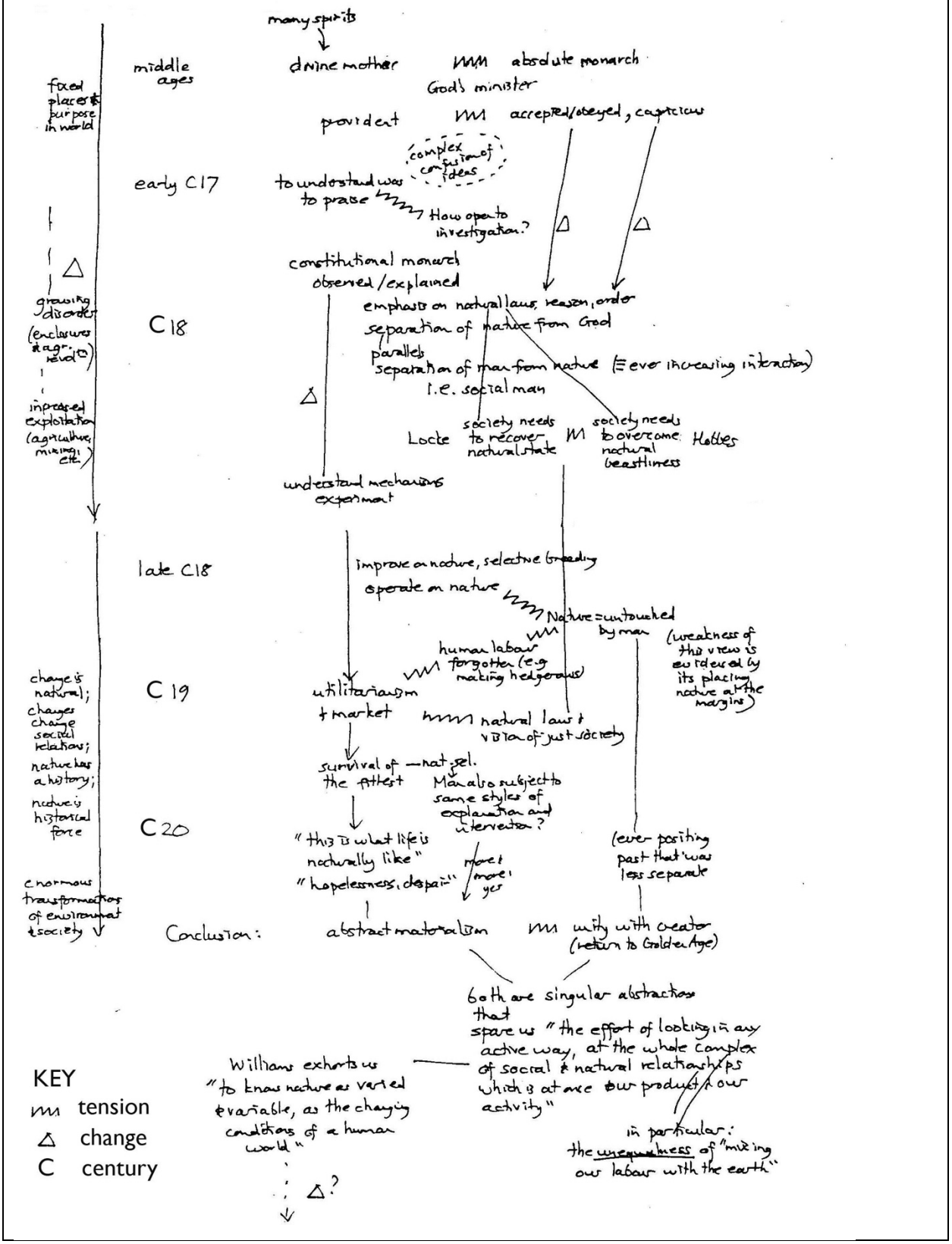
This schema, which builds on Williams (1980) helps to keep distinct:

- nature vs. "nature" distinct (column 2 vs. columns 3 & 4)
- literal ideas about nature vs. ideas interpreted in terms of favored the social order (col. 3 vs. 4)
- untouched by human activity vs. including human activity (row 2 vs. rows 3 & 4)

Peter Taylor 10/95, revised 3/99

		nature = actual physical, material (incl. living) world	"nature" = idea about nature	
			read literally (right way for us to behave or for society to be ordered; or we can expect problems if we deviate; or we better be careful if we choose to deviate)	interpreted (invoking external authority is a way to avoid debating social issues head on) •tells us about favored social order & actions *plus*
untouched by human activity		•provides/d potential "natural resources" •decreasing -> very little left now	•natural resources determine social/ econ. possibilities •"tells us about how things work without human influence impinging"	•suppresses history of human laboring and differentiation*
including human activity	humans buffeted by non-human forces, e.g., in past or prehistoric times, or w/ extreme events	•much human-made transformation through history and even in prehistory •very little unambiguous evidence about pre-historic human social arrangements	"where society's influence has not mitigated such forces we can learn about what's natural, incl. human nature"	•discounts history of human laboring and differentiation* * & the role of States
	humans dominating, e.g., in industrial-ized societies	•ever intensifying transformations of non-human realm and of human biology •very little unambiguous evidence about behavioral or social universals	"biology/ human nature constrains/ predisposes behavior in the full range of social/ economic activities"	•the emphasis on behavioral universals & humans as a species discounts differences and on-going differentiation among social groups & societies*

Williams (1980) represented in a historical timeline



Nature, a conversation

Preface

> Ideas of nature underlie a great deal of social thought and have done so through recorded history. The changing meanings of "nature" and the tensions among co-existing meanings have been analyzed brilliantly by the English cultural analyst Raymond Williams; he shows us a history readable in terms of the social order being defended or promoted.* The romantic ideal, for example, of a unspoiled places and sentiments (i.e., nature separate from "man") arose at a time when industrialization was rapidly escalating exploitation of people and natural resources (i.e., producing unprecedented interdependencies among peoples and nature), exploitation underwritten by the removal of traditional checks in the name, ironically, of the natural principles of individual autonomy and of unconstrained pursuit of utility in social transactions. Following Williams, whenever we hear the environment and its conservation being talked about we should factor into our interpretations the social concerns and social-historical location of those who hold those ideas. The recent literature on conservation efforts in colonial Africa and India, for example, has been revealing vividly how policies and actions to preserve species and habitats were greatly motivated by anxieties about changes back in the metropole and by the need to assign "primitive" peoples some less threatening place in the colonial order.
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> From Taylor, P. and R. García-Barrios. 1995. "The social analysis of ecological change." Social Science Information, 34: 5-30.
>
> *Williams, R. 1980. "Ideas of Nature," in Problems of Materialism and Culture. London: Verso, 67-85.

Suppose we want students to consider how, for example, the valorization by the romantics of untouched (non-human) nature might be interpreted in terms of the romantics' need to turn the attention away from the industrialization and colonial exploitation of which many of them were beneficiaries. It's too much to ask students to jump straight into advancing their own social interpretations of claims about "nature." First they have to get comfortable with the very idea of exposing what is not literally stated□what people state only when prodded, and then not all the time. The following conversation: i) develops this idea of interpretation in a dialogue; ii) allows students to go through and mark where they don't understand the response given or where different responses could be given; and iii) provides a start—the first five statements—from which students could write their own trialogues.

Partovo ("Humans are a Part Of nature"): Humans are living organisms. As such they are part of nature. Therefore, everything they do is natural.
Separato ("Humans have become Separate from nature"): People have lost touch with nature and that is why our environment and our society are in trouble.
Interpreto ("Interpret Socially views about nature and what is natural"): When I hear people

draw lessons from nature, I hear them really telling me something about their views on society.
Separato: You'll have to explain this interpretation to me, because, without a sense of what is natural and what is unnatural, anything is acceptable.
Interpreto: But Partovo has a sense of what is natural that tells him everything is acceptable.
Separato: Is that right?
Partovo: Yes.
Separato: So you mean mad cow disease, polio, AIDS, and so on are acceptable?
Partovo: Um, yes. We could look at them as forms of population control for the human species.
Separato: So you wouldn't invest in research for AIDS treatments?
Partovo: No. And I don't think the government should either. AIDS affects mostly gays and IV drug users. Their practices do not meet widely held community standards and so they don't deserve society's help.
Separato: I think you are out of date about who gets AIDS. But, putting that aside, I thought you said anything humans do is natural and thus acceptable.
Partovo: Well, not everything.
Separato: So, what is and what is not?
Partovo: Look, I overstated my position. What I do know is that it is not consistent for environmentalists to argue that draining wetlands disturbs the balance of nature, while putting out forest fires to keep a national park scenic is OK.
Separato: I think that the National Park Service is reconsidering its fire policy -- whether it is better to do preventative control burning or not; whether to allow lightning fires to burn or not.
Partovo: So humans get to decide what kind of (non-human) nature is the one they want?
Separato: Not in any arbitrary way; forest ecologists use the best science available to advise the NPS on this.
Partovo: "Scientists know best" -- I thought your line was that we'd lost touch with nature, not that we needed to listen more to scientists. But now I think about it, you did support research for an AIDS vaccine, right? So you don't mind if scientists intervene to limit interaction between humans and (non-human) nature in the case of the HIV virus. In what ways exactly do you want us to regain touch with nature?
Separato: I guess I also overstated my position. Basically what I want to say is that we have to remember that we're dependent on foodchains for much of our food, plants for our planet's oxygen, microorganisms inside us to digest our food well, and..
Partovo:... microorganisms for our beer, bread, sewerage treatment works, and thus clean water. Or do you think these processes are unnatural because humans have harnessed them for our own purposes?
Interpreto: Can I interrupt here? Separato, are you concerned by the fact that your reasons for getting in touch with nature are couched in terms of benefits to humans, and are not for the sake of (non-human) nature?
Separato: I am concerned for non-human nature. Moreover, I'd like to break down the distinction. That is, in the long term I would like humans to live as if they are one part of nature among many other interconnected parts. However, I have learned through experience that most people will pay more attention to the environment only if I give them reasons in terms of human benefits.
Partovo: You want humans and non-humans to be all part of nature. This sounds like the

position I began with. And in this unified picture harnessing microorganisms becomes natural, no?
Separato: You are giving me a hard time. Yes, beer, bread, etc. are OK. But don't slip back to claiming that everything human technology produces is OK. Oil spills, for example, kill animals, devastate fishersies and that, in turn , threatens the livelihoods of fishing people.
Partovo: Biotechnology is producing oil-spill cleanup bacteria.
Separato: I think it would be better to prevent oil spills in the first place.
Partovo: Maybe, but I'm not certain. Energy is vital to the economy. If oil companies were more heavily regulated and energy prices rose as a result, the economy would grow more slowly -- and probably lose out to countries that accepted a greater risk of oil spills.
Separato: It wouldn't be so bad if economic growth were slower.
Partovo: I suspected you might say that. But think -- if the economy grew slower, there'd be less money for R&D. And we'd be less likely to develop the efficient solar cells and fusion power we need to reduce greenhouse gas emissions. In other words, the risk of oil spills may be just what we have to accept if we are to eliminate CO2 greenhouse problems.
Separato: You're making a lot of unsupported assumptions about where oil companies invest profits, whether the promise of fusion power is worth investing more and more billions, and so on.
Partovo: I trust corporations to invest their profits well to make new profits. And I, like you, expect that science can produce results.
Separato: I don't have as much faith in corporate-driven R&D as you do. Or in Big Science such as nuclear fusion. Priorities for research should be for health and ecological sustainability -- and not for military might or corporate profit. I mean, have you read the figures for the costs of containment and cleanup of wastes, chemical and nuclear, put into the environments around military installations since WWII?
Partovo: I concede that mistakes may have been made, but the military didn't only produce nuclear weapons and toxic wastes. Many technologies that you rely on are spinoffs from military R&D.
Separato: Like teflon? I could do without that!
Partovo: How about computers and the internet. Have you used email to organize an environmental campaign lately?
Separato: OK -- there are some benefits I accept, but go back to the costs. Someone will have to pay these, and that's going to be a big drag on the economic growth you favor.
Partovo: Maybe the costs won't be so great if we just abandon the areas and let nature take its course.
Separato: Not everyone can pack up and move away from toxic-contaminated sites.
Partovo: Agreed. But you should remember that some people move into such areas when the price of real estate drops to levels they can afford. That's the way markets work to balance supply and demand. Dare I say, it's a natural process?
Interpreto: I suspected you would. And by that thinking it's then natural or, one might say, acceptable, that the people who move into the area suffer the health costs, while the corporations that secured the military R&D contracts gain the profits. The general point I want to make is that almost everything that both of you has said in trying to defend your views about nature has been based on your views about acceptable vs. unacceptable aspects of society. So, Separato, I don't think "nature" holds up as a point of reference for deciding what's acceptable or not.

Separato: But if not nature, what else?
Interpreto: You've already told us what -- for you it's human health and ecological sustainability; for Partovo, it's economic growth, with risks that can be distributed unequally among groups within society.
Partovo: I might observe that the notion that we can plan for ecological sustainability in a complex world sounds as full of "unsupported assumptions" as Separato criticized me for having with respect to economic growth and technological development.
Interpreto: Right -- I'm glad Separato's point sunk in enough for you to wield it in return.... Separato, you're looking perplexed. What are you thinking?
Separato: I know ecology is complex, all the more so when humans are involved -- as is almost always the case. And I admit that I invoke simple ideas such as "draining wetlands disturbs the balance of nature." But I do this to grab attention. Once I have it, I can point out the decline of waterbird and migrating bird populations and get people interested in checking development. I just wouldn't get to first base if I said, "I'm against development."
Partovo: And you're not against all development, either. I think you like national parks to be fenced off from farms and for those parks to be managed so that campers don't destroy the forests, kill the animals, pollute the lakes...
Separato: And you're not for all development either. I think you like the vacations I've heard you take on the clean uncrowded beaches of Cuba.
Partovo: (Sheepishly) And I've also enjoyed going with my family on nature tours in the Amazon and in Kenya.
Separato: But, back to my worry. I have to reduce complexity if I'm going to get attention and enlist people into a campaign. It's not until we have people involved that we can even get research done on the ecological dynamics -- to establish how vulnerable the wetland is; how quickly it could recover from stress; whether we can create a new wetland on land developers don't want. And that's just the research needed on the ecological dynamics. Imagine if I had to research the economic costs and benefits before raising my concerns!
Partovo: You could rely on developers to assess the costs and benefits. They wouldn't go ahead if they were likely to take a loss.
Separato: There you go again -- you forget that corporations make sure that they don't carry all the costs. They displace some on to other people and rely on not having to pay for loss of wildlife populations when development destroys the animals' habitats.
Partovo: OK, but let me echo your concerns. If we had to assess all the costs -- present and future, social and environmental -- of proposed projects, it'd take years before we could advance on new industry and other development. The economy would be greatly constrained. And we all need a vibrant economy.
Separato: We don't all benefit equally and some bear greater costs...
Partovo: ... OK. OK. But that's unavoidable. Anyway, egregious abuses eventually lead to reform legislation and government regulation.
Interpreto: That seems a very coarse way to take environmental and health costs into account. In fact, you're both claiming that analyses of ecological, health, and economic dynamics are too complex to be the basis of social decision making. This appears to be a claim about how the real world works. I know you're not refering to nature -- trees, animals, etc. -- but just as I said at the start about ideas of nature, these ideas about the "real world" build in ideas about your favored social arrangements.
Partovo & Separato: Huh?

Interpreto: You're assuming, for example, that some participatory form of on-going planning and assessment is not possible. The absence of this possibility then warrants Partovo trusting corporate and military decision makers to balance benefits and costs, and warrants Separato resorting to dramatic rhetoric -- "Act now to save the wetlands!"
Separato: And you think that such participatory planning is possible. That explains why you point to the unspoken messages behind our statements -- you want to check the power of simple accounts of the ecological and social world and counter the rhetoric of crisis management that gets associated with those accounts.
Interpreto: Touch□.
Partovo: I'm getting dizzy. You're interpreting our statements in terms of social views and commitments that we didn't state...
Interpreto: Or, at least, only started stating when prodded...
Partovo: OK. And now Separato is saying that this very interpretive stance of yours is itself subject to non-literal interpretation?
Separato: It's even more complicated than that. Interpreto has faith in the ability of people to understand complex processes and participate in decisions about investment and social policy. So he seeks to undermine our approaches and their implications about social action and to boost his approach. We're all involved in intervening in social processes. Therefore, we should examine empirically whether my environmentalist rhetoric, Partovo's developmentalist rhetoric, or Interpreto's critical interpretations of us have the most impact.
Furthermore, Interpreto, if you prefer the more complex, why do you focus on interpreting our more simple statements? Instead you should present to us some complex accounts of particular cases. At the very least, to help me get beyond "do not disturb natural balance" type rhetoric, I would like to know what ecological and social principles can guide our interventions with/in nature.
While I'm on this roll, I think it would be better if you -- together with a group of collaborators -- demonstrated on-going, participatory planning and assessment. Or else, we would be justiied in interpreting your emphasis to date on critical interpretations as indicating your confidence in the political impact of ideas, words, and text. Could it be that practice is secondary in your framework?
Interpreto: I think you're both right to challenge me. Raymond Williams' life's work -- and I have been taking him as a model today -- focused on literature and politics. The correlations he draws between ideas people have about social and natural arrangements -- I am impressed by them. But he does leave me wondering what people actually do so as to end up with such connected ideas. I'd like him to say more about the social interactions and negotiations through which humans come to know the world.
Partovo: I hate this -- now you are distancing yourself from your role model. Can't we keep this simple?
Interpreto: Yes and no. Let me observe that in this discussion a Williams-type perspective has opened up questions you had been avoiding, and it has exposed assumptions you were taking for granted. In this light, even if simple rhetoric and accounts -- "(non-human) nature is in fragile balance"; "economic processes adjust investment and R&D choices to respond to costs and demands" -- are sometimes powerful, wouldn't it be better to have a more complex account to complement that? Furthermore, suppose you were simply committed to mobilizing people to act (or, in Partovo's case to let corporate managers act for them), I think more complex accounts would be needed to help you understand when the simple rhetoric will be

powerful. That isn't always the case. And, even when it is, simplicity sometimes engenders unintended, undesirable consequences.
Separato: Hold on. I understand the undesirable consequences of Partovo's accounts -- they help distract help corporations and the military avoid paying the full costs of their projects. But what are the undesirable consequences of drawing attention to the environmental costs of development?
Partovo: Let me answer. Environmentalist rhetoric, especially of the apocalyptic kind, undermines people's commitment to working hard to keep the economy thriving.
Interpreto: Maybe, but that's not what I had in mind. I suggest that you wait for Peter Taylor's classes on neo-Malthusians, the so-called "tragedy of the commons," and global models to see how environmental rhetoric can have undesirable consequences.
Separato: OK, I'll wait. But let me admit that I'm worried by where you're leading us with your critical interpretations of ideas about nature. I now doubt your earlier reassurances that I have some alternative points of reference, namely, health and ecological sustainability. If one shifted to more complex analyses, health and ecological sustainability would start unraveling too. We would be left without any firm handholds.
Interpreto: I don't think that must be the case. But, to convince you of that, words and arguments are of limited power. I believe that we'd have to join in and experience some participatory processes of social governance.
Partovo: We already do -- we all vote in elections, right? I know that voters aren't all informing themselves with analyses of "complex ecological, health, and economic dynamics" as you call them. But voters elect representatives whose decision making takes into account the advice of those to whom they delegate the tasks of analysis.
Separato: You must know that that is a seriously idealized picture of how decisions are made in government.
Partovo: Maybe, but tell me: Would you be happy if we moved towards this ideal of social decision making by elected representatives following the advice of environmental analysts? Would you -- or Interpreto for that matter -- accept an appointment as such an analyst?
Separato: I don't know.
Interpreto: I'm afraid we're too far from that ideal for me to make a well-informed response.
Partovo: It's easier to be a critical interpreter of the messy present, isn't it?
Interpreto: Yes, but I think there's more to learn from our conversation than that...

Peter Taylor, 10/97, slightly revised 2/99

Rethinking nature/culture

Nature/culture distinctions play out in many different and contradictory ways. In turn, there are multiple rethinkings. The list below began with some that arose or lurked around during the 1996-97 Rutgers University seminar on "Rethinking nature/culture." Please add to and play with the list. Play is important because, even if we reject certain of the dualisms, the ones we accept are probably infected with resonances from the others.

N = Nature, natural, universal,.environment..
C = culture, artificial, particular,.society..
R = ways the divide has been rethought
OQ = open questions remaining from or raised by the rethinking

1.
N = markets
C = non-market residue in social relations ("market failure")
R = real markets are always embedded in political-economic relations

2. anti-toxics
N = (health of) human bodies
C = chemical ("toxic wastes")

3. environmental justice
N = political-economic processes are common to all societies & fractions of society
C = communities, having specific identities, are specifically targetted

4.
N = global integration
C = local resistance

5. in the appeals of environmental movements:
N = (non-human) nature, which has lessons for us
C = people, out of touch with (non-human) nature
R = experience at the frontier (i.e., at the periphery of society and in touch with non-human nature) enhances a person's ability to intervene back at the center, in modernization (Quiroga), and in family, nation, empire (T. Roosevelt)

6a. continuous
C = culture is part of
N = universal nature (and thus N is relevant to social concerns)
6b. discontinuous
N = force external to culture (and thus a source of cultural authority)
R = culture & nature continuous & discontinuous (Kovel & Smith)

7.
N = human bodies & non-human nature, dominated by
C = technology

R for 5,6 & 7 (R. Williams)
Ideas about nature, naturalness & universality are projections of ideas about favored social order. The authority of these ideas is a socially maintained device, with a definite history tracing back to a human/ divine divide

8.
N = self-interested rationality
C = particular norm-governed behavior
R= sometimes one, sometimes the other -- it's a contingent & pragmatic matter (A. Vayda)
OQ = when one; when the other? is there any underlying sense to this?

Another R = norms can be traced back to self-interested rationality (iterative, evolutionary game theory)

9.
N = oral ("natural language")
C = text

10.
N = unmarked (by race, gender,...)
C = marked

11.
N = Life
C = Human intelligence & language
R = Replicating informatic devices (Santa Fe Institute)

12.
N = Replicating informatic devices
C = ? (is anything residual to the above?)

13a.
N = Female
C = Male
13b.
N = Other cultures. primitives
C = Euro-, white, advanced
R = drag & whiteface transgress these divides
OQ = but they also reinforce the dichotomies

14.
N = adaptive, self-regulating
C = disordered, crisis-prone

15.
N = simple
C = complex

16.
N = infants & children
C = adults

17.
N = dependent
C = autonomous

18.
N = insane
C = sane

19.
N = children and equal opportunity
C = adults and choice of hazardous jobs

20.
N = markets allocating adults to hazardous jobs & localities
C = protecting children from harm not of their own choice

21.
N = rights to liberty
C = rules constraining children

22.
N = foundations to morals, knowledge
C = all is discursive practices
R = contingent foundations (J. Butler)

23.
N = focus of conservation & preservation campaigns
C = resource management and use

Peter Taylor, 1997

The structure of origin stories

1. Introduction

- The Ideas of Nature chapter introduced the idea that interpretation exposes what is only implicit in an account. This chapter interprets story-telling, focusing on origin stories both outside science and inside.

- Story tellers select elements and arrange them in a sequence. Selection and arrangement simplify the complexity of influences needing to be considered to understand the outcome and cover over the uncertain or unknowable information. The story-teller not only gives emphasis or credence to the outcome, but can also try to make plausible the causality implied in the story.

- Stories are more compelling if they adopt a familiar structure and if they resonate with other stories.
- The influence of structural (or structuring) themes can be seen by identifying them and asking what would happen to the account if an opposing or alternative theme were employed.
- Playing one theme off against another and creating some interpretive tension is an example of critical thinking in the sense of understanding ideas or practice better by holding them in tension with alternatives.

- Origin stories are important because they are used to make sense of and often to justify the state of affairs we find ourselves in now.
- Many scientific accounts can be read as stories or narratives (Landau as described in Lewin), especially when
  1. they attempt to deal with uncertain or unknowable information, e.g., in accounts of origins—meaning both the point of origin and the subsequent history—and evolution; or
  2. with many connections and causes rather than a few experimentally controlled factors.

1b. Mini-lecture

- Initial questions: Why tell stories? How do stories get to be memorable and persuasive? Why are origins important? Why do we tell stories to explain origins?
- Examine first chapter of Genesis (King James version) to introduce the idea of looking for themes that structure biological accounts, especially those used to explain origins and the history of life.
  - Schema
- Additional question: Is story-telling an acceptable part of science?
- An invented account of the origin of human intelligence that employs non-standard structuring themes.

2. Readings

Hrdy, S. B. (1981). "An Initial Inequality". Pp. 20-23 in The Woman That Never Evolved. Cambridge, MA: Harvard University Press

Precis TBA

Lewin, R. (1987). "The storytellers". Pp. 30-46 in Bones of contention: Controversies in the search for human origins. New York: Simon & Schuster

- Precis TBA

Martin, E. (1991). "The egg and the sperm: How science has constructed a romance based on stereotypical male-female roles." Signs 16(3): 485-501.

- Precis TBA

Full versions: See password-protected readings

- Locate 1 or 2 accounts in textbooks or elsewhere of either a) sperm and egg production; b) the passage to fertilization; or c) contact and fusion. Do the accounts you find reinforce or depart from Martin's analysis of gender bias? Do they fit Landau's structure of stories told about human evolution (as described in Lewin)? Come to class prepared to discuss these questions.
- Come with ideas and questions about how to extract the themes that structure Hrdy's account of the origin of sex differences.

3. Activity

Based on preparation above, pairwise discussion of Martin's interpretation and analysis of structure of Hrdy, followed by whole-class discussion.

(Time permitting) Given that sometimes we describe our lives in a linear narrative; sometimes we emphasize its multiple strands, contingency, etc., reflect on the different situations in which you use the different themes to organize your life descriptions.

4. Synthesis and extensions

Why do we tell stories?

- See introduction. More answers TBA.

How do stories get to be memorable and persuasive?

- One answer is when they are biased in ways we accept (see discussion of bias). More answers TBA.

Why are origins important?

- Why not simply start from where you are? Possible answer: Because origins connect the present to the future, that is, to who we are and where we are going. That is, origin stories can be read as explanations and explanations as justifications.

Is story-telling an acceptable part of science?
TBA

Structural themes in stories /narratives /historical accounts
Stories are more compelling if they adopt a familiar structure (see Landau's structuralist account) and if they resonate with other stories (the hermeneutic emphasis). Identifying the structural themes and noticing connections between parts highlights the causation implied and perhaps exposes weaknesses in the account. For example, Hrdy's uses four dualities that at first seem to reinforce each other—large/small cell, egg/sperm, "female"/"male" unicell, female/male mammal—but then allow us to ask what is anything the relationship is say between a sperm and a male. After all, sperm can carry an X or a Y chromosome. To pursue critical thinking around structural themes, use the pairings to reflect on how the story could appear if the other theme in the pair had been emphasized.
Note: Stories may be only part of explanations or arguments, so, when trying to see which of the themes below inform or structure an account, concentrate on the historical part and its end-point—the outcome that the account is trying to make understandable. The rest of the author's exposition may provide evidence for, or render plausible, various elements of the story, but this is a secondary issue. Also, an account may work in more than one structural theme.

A. In each of the following the first theme is more common in biology and allied social thinking, while the second is an alternative that is more open and difficult to analyze:
1. linearity one person or entity is the central subject followed through the course of the story, inc. life course maturation;.
(A chain of if-then connections does not necessarily make a narrative linear because the story can be weaving together several different types of phenomena, i.e. not just following one entity.)

***vs.* multiple strands** (in the one story -- multiple explanations of the same phenomenon don't necessarily make an account non-linear.)
(Even if different phenomena enter the story without much background being given to them, consider what they entail. For example, in the speculative account of the origin of human intelligence the basic tendency of primates to be social was assumed in having the early humans stay and care for the

premature babies, rather than leaving them to die. This then constitutes another strand woven into the story)

2. development - unfolding - essential trajectory everything, including the endpoint, is implied from the outset -- if you have an egg you'll eventually get an adult chicken -- if you have a society you'll inevitably have it modernize, democratize, etc. Of course, not everything fits, but the deviations are mere *deviations* from the ideal course.

***vs.* critical interventions** along the way (by Gods, heroes, random mutations) move things along

3. progress everything is climbing ever higher, getting better, or the opposite, regress -- everything is getting worse, declining from the Golden Age of the past.

***vs.* simply change** most of what happens doesn't contribute to the final outcome, e.g. Ediacaran fauna & Burgess shale do not contribute genealogically to present taxa

4. directional, even determined very few steps from start to outcome, or very few opportunities for anything different to have happened. Includes *Whig history* (= the past is presented so that the present is made to seem a necessary consequence of it) -- it's hard to see any other directions things could have gone (side-branches, failures, etc.)

***vs.* contingent** and thus winding, branching path -- lots of places for things to have gone another way - dicey connections between events and “quirky changes” (the path to the end-point is windy, not direct)

5. adapted, fit to situation current function seems so good, even *optimal* or *perfect*, that the story doesn't have to fill in much history of how it came to be

***vs.* constructed** many strands come together or coalesce to produce an outcome, which is thus open to change at many points in the process. “Characters = genes plus environment” is a very weak form of construction, especially if the central thread of the story is genetic, leaving the environment just a modifier of the result.

6. gradual & continuous steady accumulation:"evolution not revolution"

***vs.* episodic, even catastrophic** bursts of activity or happenings, e.g. Cambrian radiation, post-Mesozoic radiations of birds and mammals

7. naturalism human social behavior and arrangements are natural, i.e. do not need specifically social explanation

***vs.* humanism** explain humans in specifically human terms (see also B8 below).

8. dualisms categories come in pairs (e.g., homosexual/heterosexual; male/female)

vs. multiplicities divisions into two types obscures a lot of diversity (e.g., variants of sexual preference)

B. In each of the following the themes are equally common and often co-exist in tension within the one account (we'll say more about these themes in later classes):

1. uniformityinsist on invoking the same causes then (in the past) as you see now

***vs.* historically located** unique causes, or causes that need reference to the particular situation and timing, i.e., events wouldn't be true in all times or places

2. balance of nature(see also *adapted, stability*)

***vs.* struggle for existence** necessarily involving sub-optimality and imperfection (at least transiently)

3. fixed, stable places, niches

***vs.* scramble for a place**

4. stable equilibrium

***vs.* change**

5. biological causes of changing conditions of life

***vs.* physical/ climatic determination**

6. Nature integrated, like an organism

***vs.* aggregate of individuals**

7. Nature passive

***vs.* active, creative**

8. anthropomorphism depicting non-humans (living or non-living) in terms of human motivations, emotions, social arrangements, etc.

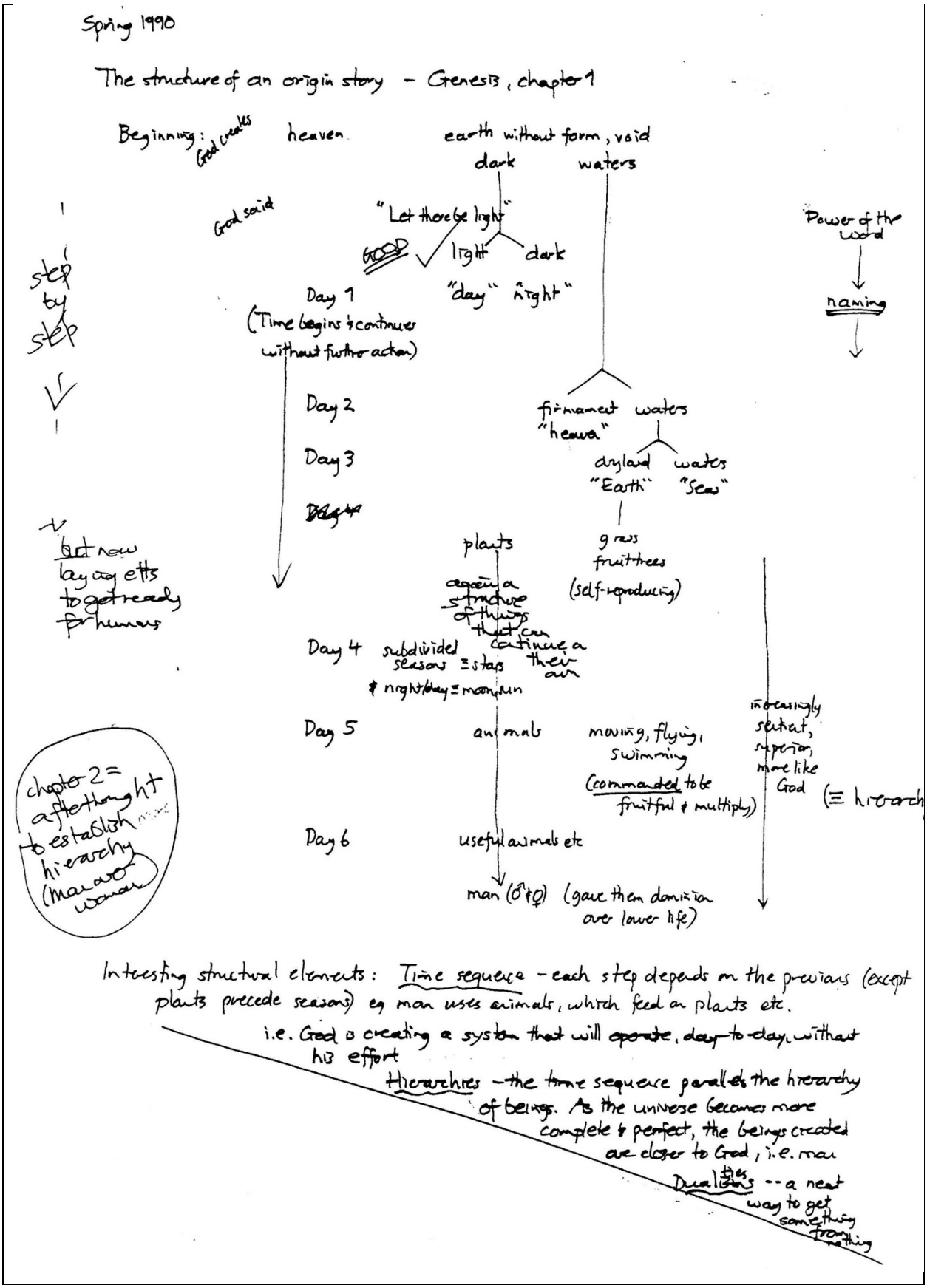
***vs.* naturalism** human social behavior and arrangements follow the same rules as the rest of nature. (These themes can reinforce each other if the idea of what's natural is anthropomorphized.)

9. Parallels and borrowing (e.g., Hrdy's small/large cell = sperm/egg = male/female mammals)
***vs.* Unique and singular** (e.g., explaining differentiation of cell size in ancient unicells, anisogamy in germ cells, and size-activity differentials in mammals each by different means)

An activity: Refer to the structural themes above to analyze E.O. Wilson's (1980, 279) story about the evolution of human homosexuality, which is preceded and followed by other points relevant to his account, http://bit.ly/XHsxgi (starting end of first column).

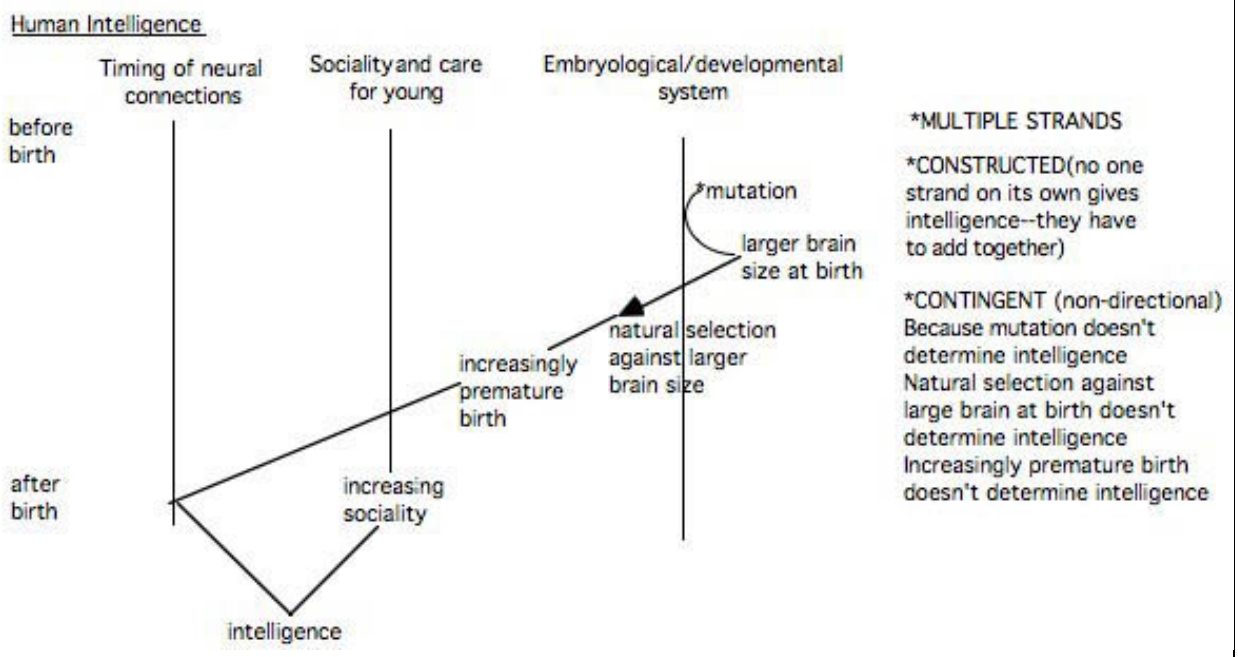
5. Connections and resources

5b. Add to this blog post to make contributions to the revision of the chapter above or to an annotated collection of readings and other resources related to the chapter.
5c. Adaptation of themes from the chapter to students' own projects of engaging others in learning or critical thinking about biology in its social context. Suggestions:
i. Identify the leading or dominant explanation or account of some issue that is important in the area of your project. Identify the structural themes used. Invent an alternative account that emphasizes the alternatives to the structural themes. e.g., emphasizing the key role of contingency instead of a directional account.
ii. Same as i, but instead of inventing the alternative, look for one already published or promoted by someone in the area.
iii. Brainstorm with instructor


Spring 1990
The structure of an origin story - Genesis, chapter 1
Beginning: God creates heaven
earth without form, void
dark
waters
God said
"Let there be light"
GOOD
light
dark
"day"
night"
Power of the word
naming
step by step
Day 1
(Time begins & continues without further action)
Day 2
firmament "heaven"
waters
Day 3
dryland "Earth"
waters "Seas"
but now begin to get ready for humans
plants
grass
fruit trees
(self-reproducing)
agent a structure of things that can continue their own
Day 4
subdivided season = stars
& night/day = moon/sun
Day 5
animals
moving, flying, swimming
(commanded to be fruitful & multiply)
increasingly abstract, superior, more like God
(= hierarch
chapter 2 = afterthought to establish hierarchy (man over woman)
Day 6
useful animals etc
man (♂ & ♀)
(gave them dominion over lower life)
Interesting structural elements: Time sequence - each step depends on the previous (except plants precede seasons) eg man uses animals, which feed on plants etc.
i.e. God is creating a system that will operate, day-to-day, without his effort
Hierarchies - the time sequence parallels the hierarchy of beings. As the universe becomes more complete & perfect, the beings created are closer to God, i.e. man
Dualities -- a neat way to get something from nothing

An invented account of the origin of human intelligence that employs non-standard structuring themes. As a preliminary, keep in mind that in placental mammals most neural connections are made before birth.

In a small group of our hominid ancestors a mutation that affected developmental timing occurred and spread by genetic drift through the group. The effect of this mutation was to prolong the period, characteristic of mammalian fetuses, in which relative growth rate of the brain is greater than the growth rate of the body. The immediate effect of this was to increase the brain size at birth making births more difficult than before. Individuals who were born early and thus smaller (and their mothers) tended to survive better. The premature individuals, however, needed care -- they weren't able to hang on for themselves, move around, and so on for some months. Their caregivers tended to remain more on the ground and more sedentary during this time, enhancing both the level of face-to-face interaction (the parents' hands being free from holding on to branches) and the level of social interaction involving and surrounding the babies. The babies having been born premature, however, meant that this was just the period when neural connections were being set down. The neural connections then reflected this high level of social interaction, whereas other placental fetuses experience mostly the physical environment of the womb while their connections are being set down. The sophistication and flexibility of these post-birth neural connections accounts for human intelligence.



Bias has a range of associations

Let us distinguish bias and Bias

bias

1. X's bias leads them to accept assumptions and propositions without examining alternatives.
2. The assumptions and propositions are one set of elements in the construction of scientific knowledge from many elements building upon each other. That is, all work is biased. (Image: biased bowls)

vs. Experimental tests and peer review eliminate bias in science. (This view assumes, incorrectly, that all alternatives are raised and considered in normal science.)

3. 1=> Use the assertion that X is biased to counterpose alternative, and ask what difference it makes in examples cited, observations made, arguments addressed and conclusions reached. That is, bias, provides an entry point for further investigation.
4. 2=> We should not expect bias to determine the outcome.
5. 2=> Changing biased work will require changing many interconnected elements.

vs. Bias

6. Bias = accusation that X's bias is determining, that changing it would make all the difference, because everything is built upon that.
7. Accusations of Bias arise in two ways:

a) Status quo-ers have the power to discount their own biases—they are normal—while others who question and advocate specific change are Biased -- they deviate from the normal;

b) Critics of the status quo attempt to reconstruct all the interconnected elements (see 5)—to grab attention, gain new audiences, develop constituency with shared assumptions upon which further work can build, etc.

8. 7b-ers run the risk of provoking a response from 7a-ers and of selectivity, which makes them vulnerable to 7a-ers.

Which biases should we identify and work through?

Start with pervasive biases, e.g., gender (whether or not you see pervasive gender Bias).

Use theme 3 above.

Correctives, e.g., eliminating masculine generics from language.

Multiple layers in influencing an audience: The case of Darwin's *On the Origin of Species*

1. Introduction

Having been sensitized to the story telling aspect of scientific writing, to the dominant structural themes adopted in accounts or origins, and to the ideas of nature that were invoked before Darwin to support ideas of the social order (whether that was the actual, idealised, or desired order), we are now in a better position to read Darwin and interpret his ideas on evolution and on the means by which it occurs.

- Williams's account of the history of ideas of nature conveys a general trend: Ever increasing interaction of societies with/in nature -> idea that nature has a history -> evolutionary theories of nature -> contested issue: do humans evolve too?
- Darwin's specific contribution: The idea that everything in nature is adapted to its place, but that this is the result of an on-going struggle for existence, not given by creation once and for all.
- Broad-brush interpretation of Darwin's idea about how evolution happens: The idea of evolution by natural selection relates to and supports a dominant idea about social order, namely, that one's place in society is a result of a natural process of selection, and, given that the result is adapted, this is right/ justifiable/ as good as we could hope for.
- Such an interpretation raises a question: What did Darwin actually *do* in his scientific research that resulted in a theory that fits that social interpretation?

1b. Mini-lecture: Given that one of the things Darwin did was write to convince his various audiences, this lecture introduces 4 layers of argument in Darwin's text and models close reading of the introduction and part of chapter 1.

2. Reading

Darwin, C. (1859 [1964]). Introduction & Chapters 1, 3, part of 4. In *On the Origin of Species*. Cambridge, MA: Harvard University Press, 1-43, 60-96. (Available widely on the internet or via password-protected readings.)

This is the first full-length treatment that Darwin published of his theory of natural selection. He is carefully building up an argument so let us read closely, assuming that everything has a point. In class we will unpack the multiple layers of a scientific theory, in this case, the argument, analogy, metaphor, and defences. To prepare for this, make a copy of the following table and fill in the right-hand column as best you can from your reading.

	Fill in your understanding & provide quotes that illustrate or support it
Layer 1: premises leading to conclusion that evolution results in improved adaptation to local conditions	
2 majors premises of Chapter 1 & 2	
1 major premise of Chapter 3 & its consequence	
1 major premise of Chapter 4 & in combination with preceding premises, its consequence	
Layer 2: analogy	
Given the lessons of Chapter 1 about selective breeding by humans, namely,..	
then something like selection in nature should be effective because…	
Layer 3: metaphor of Natural Selection	
Associations that help readers conceive of this mechanism working so that evolution results in improved adaptation to local conditions	
Associations that help readers see that what they had learned from Natural theology can still be explained	
Associations that might not work in Darwin's favor	
Layer 4: preemptive defences	
Against objections from other naturalists and scientists	
Against objections from religious authorities	
Other issues or questions you have	

3. Activity

Clarify and extend what this scaffolding helped you learn from the reading.

4. Synthesis and extensions

A recapitulation of the early chapters of *On the Origin of Species*

(from Taylor P. J. 1998. Natural Selection: A heavy hand in biological and social thought. *Science as Culture* 7:5-32)

The Origin is about evolution, about how the diversity of forms we observe are descended from common ancestors through a series of modifications over time. Darwin's purpose was not merely to establish that evolution existed; many before him had noted the changes in fossils from one layer to the next. As he wrote in the introduction, his central problem lay elsewhere:

> It is quite conceivable that a naturalist, reflecting on the mutual affinities of organic beings, on their embryological relations ... and other such facts, might come to the conclusion that each species had not been independently created, but had descended, like varieties, from other species. Nevertheless, such a conclusion, even if well founded, would be unsatisfactory, until it could be shown how the innumerable species inhabiting this world have been modified, so as to acquire that perfection of structure and coadaptation which most justly excites our admiration (p. 3).

Darwin had to provide a convincing mechanism for evolution, and, moreover that mechanism had to account for adaptation-such as the long antennae which enable blind cave crayfish to sense their way in the dark. His contemporaries drew their conventional wisdom from Natural Theology. The adaptation between organisms and the environment, so marvellous and harmonious, necessitated a designer; adaptation was evidence of God. Darwin's counterproposal to explain adaptation and evolution was, of course, natural selection. Given the absence of direct evidence of natural selection actually happening, however, it was no small task to win his readers over to his theory. So he advanced on argument which has several layers. The centrepiece of this argument is laid out in his first four chapters which I will recapitulate in sequence.

In Chapter 1, entitled 'Variation under domestication,' Darwin observed that variation exists in the characters of organisms such as in the size of udders of cows and goats. Variation never runs out, though its causes are unclear (Darwin believed that new environments acting on the reproductive system elicited new variants). Variation existing in parents often appears in offspring, even if it does so imperfectly and mysteriously, sometimes disappearing only to reappear in later generations, e.g. baldness in grandparent and grandson. In short, variation among organisms exists and is partially inherited in offspring.

Darwin developed his observations of variation further: Variation can be accumulated. Darwin described in detail the extreme differences among the runts, tumblers, pouters, and so on at the London Pigeon Club. Darwin speculated that if ornithologists were to encounter different domestic pigeons back in the wild they would classify them into different species or even into different genera. Yet, it seems, all domestic pigeons are modifications of one species of rock pigeon; one ancestor had, over a long period of time, given rise to all the diversity of descendants. The divergence from the common ancestor was brought about by humans selecting variants and moulding the lineages of animals to human wants and fancies. The accumulation of differences occurs in small steps, not all at once. Sometimes the differences

are imperceptible except to the specialized breeder and may even occur unconsciously. In another example, Darwin wrote of Mr. Buckley and Mr. Burgess both sincerely striving to breed true from the same original stock of Mr. Blakewell's Leicester sheep, yet after fifty years their two flock looked quite different (p. 36). And so, such stories of the effectiveness and gradualness of selection by humans make up the first chapter of Darwin's book about evolution in nature.

Chapter 2, 'Variation under nature,' can be summarized for our purposes as: variation also exists in undomesticated species and tends to be reproduced in offspring.

Chapter 3, 'Struggle for existence,' begins with Darwin rewriting Malthus from society into the natural world. Organisms tend to increase their numbers exponentially; in 500 years one pair of slow breeding elephants would, Darwin calculated, multiply to 15 million animals. Resources do not, however, match this increase, so not all offspring can survive. Because of this 'hyperfecundity' (a modern term, not Darwin's) among the offspring there must be a struggle for existence. Darwin used this term in 'a large and metaphorical sense' (p. 62). Existence included success in leaving progeny. Struggle included getting food from other organisms, coping with drought, competing with other animals for food in times of scarcity, a parasite's finding of a host, and so on. Darwin noted that competition is strongest among individuals of the same species and in other situations is generally less focussed. Darwin observed, taking what we would now call an ecological viewpoint, that checks and relations among organisms are very complex and can produce unexpected results. For example, the introduction of one species, Scotch fir, into heathland led to the flourishing of many species of plants, insects, and birds not previously seen in the heath (p.71). Furthermore, as if the harsh connotation of the term struggle needed mitigation, Darwin began the chapter by reminding the reader about the exquisiteness of adaptations evident in the 'humblest parasite [clinging] to the hairs of a quadruped'(p. 61). And he ended with the wonderful reassurance that when 'we reflect on this struggle, we may console ourselves with the full belief, that the war of nature is not incessant, that no fear is felt, that death is generally prompt, and that the vigorous, the healthy, and the happy survive and multiply' (p. 79).

But, if not all offspring can survive, which survive? Chapter 3 posed this problem; chapter 4, 'Natural Selection,' resolved it as follows: In the struggle for existence those with favourable variations are preserved, and those with injurious variations are rejected. Or, in Herbert Spencer's phrase, the fittest survive. Darwin, however, preferred his name for the process and thoroughly exploited the likeness of Nature to a Selector:

> It may be said that natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of

each organic being in relation to [i.e., in its fit-ness to] its organic and inorganic conditions of life (p. 84).

Nature the Selector is, he added, immeasurably superior to Man:

> Man can act only on external and visible characters: nature cares nothing for appearance, except in so far as they may be useful to any being. She can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life. Man selects only for his own good; Nature only for that of the being which she tends (p. 83).

An interpretation of the layers of Darwin's presentation

(from Taylor P. J. 1998. Natural Selection: A heavy hand in biological and social thought. *Science as Culture* 7:5-32)

Now that we have a first reading of Darwin's argument for natural selection as the mechanism for evolution, let me unpack the multiple layers therein. The first layer is a straightforward deduction. If we have evidence of variation, inheritance of variation, and hyperfecundity, then there must be a struggle for existence. And, in the struggle, if those more fit to the conditions of life survive and reproduce, then the next generation of offspring will on average be better adapted to those conditions. Notice, for I will return to this later, that this deduction comes in two logical stages.

1) Variation, inheritance and hyperfecundity on their own imply only that there will be differential representation of variants from one generation to the next. (This could lead nowhere in particular.)
2) Survival (and implicitly reproduction) of the fittest, or natural selection, tends to give us, in addition, improved adaptation.

The second layer of Darwin's argument is the analogy. Chapter 1 in all its length serves to impress on his readers that selection is effective under Man. Given that the same elements exist in Nature, and act even more strongly, selection should, according to the analogy, be effective under Nature.

The third layer is the metaphor of Nature as Selector. Metaphors are devices that animate thinking about one concept through the connotations of another. What would have been the connotations of a Selector to Darwin's readers? First, he was appealing to an audience well versed in Natural Theology and the use of Nature as evidence of God's design. Darwin's mechanism for evolution eliminates the need for a designer and might seem radically opposed to Natural Theology. However, if Nature were seen as God's handmaiden, then Darwin could be read quite comfortably as another interpreter of natural laws laid down by God. Furthermore, English Natural Theology had become decidedly anthropocentric, with God designing the world for the benefit of humankind-utility was as important as harmony in this design. To an audience well aware of the active shaping of plants and animals by selective breeding, the invocation of a

Selector would have rung true. Darwin's audience was also a bourgeois audience, susceptible to appeals to universal man, and able to use discussion of the abstract rights of all men to insulate itself from the actuality of industrial and imperial exploitation, slavery, and the subordination of women to men. A unitary Nature, therefore, resonates with this unitary Man; Natural Selection, in contrast to the decentered, unfocussed connotations of the term 'survival of the fittest,' cuts through the complexity of checks and relations to become a singular and abstract force (Williams 1980, see also Young 1985a, 1993).

Such connotations were felt unevenly and with qualifications by Darwin's different contemporaries. The power of metaphor is precisely that connotations are neither dictated nor unambiguous. Let me add two other important connotations invoked by Nature as Selector, ones that caused problems for Darwin's theory. The first is progress. Selective breeding is also called plant (or animal) improvement; selective improvement is progress. Darwin seemed to recognise, however, that adaptation to local circumstances did not guarantee unidirectional, global progress. He avoided the term evolution which associated change with a steady overall improvement. (This connotation persists to this day...) Darwin’s guard slipped in the Origin only once, when he used 'evolved' in the concluding passage of the book. There he exalted readers to see not pointlessness in the struggle for existence, but 'grandeur in this view of life' in which, 'from so simple a beginning, endless forms most beautiful and most wonderful have been, and are being, evolved' (p. 490). However Darwin's contemporaries did not match his caution. Evolution as popularized by, for example, Spencer in the Anglo world and by Ernst Haeckel in Europe was equated with progress. We need only think of the common pictures of marching sequences of primates from an ape to a human (almost always a man), or of the trees of life at whose crown usually the human species, not other quadrupeds or multicellulars, and never bacteria.

A second problematic connotation of Nature-the-Selector proved most difficult for Darwin's theory. God-the-designer, the god of Natural Theology, is a god created in the image of Man–conscious and able to design. Natural Selection, however, proceeds unconsciously. So, if Nature-the-Selector replaces God-the-designer, the special position of humans in the natural order, next to God, is undermined. Humans become just another species, perhaps the highest point in evolution, but continuous with other species and subject to the same laws; in other words, there is a uniformity in nature. Young (1985) argues that the issue of continuity or uniformity, more than any other issue, led to the lack of acceptance by Darwin's contemporaries of natural selection as a mechanism of evolution. When the sixth edition of the Origin was published in 1872 Darwin had hedged significantly from his original exposition, adding mechanisms other than natural selection to explain adaptation. Most notably, he accepted a significant role in evolution for the Lamarckian idea that modifications of an organ through use or disuse during the parent's lifetime could be passed to offspring-an idea, ironically, much closer to human ideas of conscious improvement.

So we see that Darwin's metaphor was very active, and that some of its many connotations were

problematic for Darwin's contemporaries, and even for Darwin himself (Young 1993). Why, we might ask, was the metaphoric layer of his argument so prominent? Why not focus, as modern biologists do, on the first layer I mentioned, the seemingly straightforward deduction? To Darwin the conceptual, scientific problem was that, although there was evidence for variation, inheritance and hyperfecundity, and although survival of the fittest seemed eminently plausible, adaptation by natural selection was only a deduction from these elements–he had no direct evidence for natural selection actually in process. The lack of evidence accounts for a fourth layer in Darwin's writing–his numerous defensive moves. When in Chapter 1 he spoke of imperceptible differences, of divergence resulting from a slow and gradual accumulation of small steps over a long period of time, he was saying, in effect, 'don't expect to see natural selection happen before your eyes.' And, by stressing the complexity of checks and relations in the struggle for existence, we can hear him asking readers not to expect him to define exactly what makes one organism more fit than another: 'Simply take it like this–Some must be fitter, no? And, if the fitter survive and reproduce, then the process will look as if there were a selector.'

References:

Williams, R. (1980) 'Ideas of Nature', p.67-85 in *Problems in materialism and culture*. London:Verso.
Young, R. (1985a) 'Darwinism is social,' in D. Kohn (Ed.), *The Darwinian Heritage*. Princeton, NJ: Princeton University Press, 609-638.
Young, R. (1985b) *Darwin's Metaphor: Nature's place in Victorian culture*. Cambridge: Cambridge University Press.
Young, R. (1993) 'Darwin's metaphor and the philosophy of science', *Science as Culture* 3: 375-403.

Additional question to consider in order to delve deeper into Darwin's writing in the social-historical context in which it was written:

- What biases, problems or omissions do you—looking at his work 150 years later—notice in Darwin's presentation?
- It's not relevant that Darwin does not talk about genes or DNA, but you might consider what he does or doesn't say about how inheritance works.
- Why didn't Darwin use the word evolution in this text?
- Why is the book named *On the Origin of Species*?
- How is Darwin's theory different from Lamarck's?
- What ideas of nature from Williams's schema does Darwin employ?

Darwin, C. "Chapter 5, On the development of the intellectual and moral faculties during primeval and civilised times," Pp. viii-xxi, 158-184 In *The Descent of Man*, Princeton, NJ: Princeton University Press, 1981.

Evolution matters in thinking about humans and their social arrangements because they can be made to seem natural, and thus not requiring of social justification or change.
If social Darwinism is construed broadly as attempts to naturalize aspects of society, then Darwin was a social Darwinist.
The Descent of Man is not just a founding text in the science of sociobiology. Yes, his theoretical innovations (relative to the Origin)—reciprocal altruism, kin selection, group selection, cultural selection—foreshadow work going on today. But, these and the central structure of his science (to follow) reflect his desire to show that features of Victorian society (e.g. imperialism, poverty, meritocracy, Anglo-Saxon superiority, monogamy) were as they should be.
The structure of his work consists of five strands:
1. Victorian society is as it should be.
2. Natural selection is mechanism of evolution plus adaptation.
3. Panglossianism (from natural theology): everything is adapted.
4. Story telling to fill in gaps.
5. Naturalism: humans in society are subject to natural laws.
which come together in showing:
Features of society are produced by natural selection,
even though this requires Darwin to
invent functions for the features, and
invent historical stories in accordance with natural selection (expanded to include the extra innovations) for the origin of those features.

If you think Darwin might have been able to argue that natural selection explains social behavior without weaving in all these strands, reread the selections from Descent and note the metaphors he uses, the "facts" about higher and lower people and characters he chooses to explain, and the features whose explanation requires him to introduce the extensions to natural selection. We do not have to think Darwin was impure or just pleasing his audience. Instead, we can interpret the projection of society into science via the following multiple routes:

Ideas about social order, social "problems," and social change facilitate the scientist's work by

- getting them interested in a topic and generating questions
- getting an audience interested in the topic and generating further support and discussion -> continuing work
- setting the categories and terms and excluding potential evidence that might not fit
- setting the questions
- rendering plausible what otherwise might need evidence to support it and thus avoiding thorny issues
- providing stimulating metaphors (that can eventually turn out to be restrictive)

- allowing them to base parts of their work on data or results (e.g., skull size measurements) that were are accepted at that time but now are seen as strongly biased
- getting feedback from dominant social groups (in funding, institutions, publicity, public policy)

Eventually some time later scientists may be able to dissociate some of the scientific ideas from their original sources of social support. However, that does not undermine the argument that scientific work is woven out of many social strands and may have developed differently in different social circumstances. Moreover, some of the weaknesses in Darwin, e.g., ascribing to humans as a species some culturally specific quality, are worth being on the lookout for in current sociobiology, not to mention everyday speech and perceptions.

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5. Connections and resources

Additional readings

Moore, J. (1986). "Socializing Darwinism: Historiography and the Fortunes of a Phrase," in L. Levidow (Ed.), *Science as Politics*. London, Free Association Books, 39-80.

Precis TBA

Taylor, P. J. (1998). "Natural Selection: A heavy hand in biological and social thought." *Science as Culture* 7(1): 5-32.

Precis of part of the essay above.

5b. Add to this blog post to make contributions to the revision of the chapter above or to an annotated collection of readings and other resources related to the chapter.

5c. Adaptation of themes from the chapter to students' own projects of of engaging others in learning or critical thinking about biology in its social context. Suggestions for how to do that:

i. Identify a key author in your area and examine the premises and logic, analogies, metaphors, and defensive moves in a key writing of that person.

ii. Others TBA

Analogy and metaphor (and simile)

Definition, discussion and examples on the internet are confusing. The confusion can be pushed aside if we focus on the key quality shared by all three terms, namely, inviting readers (or listeners) to think about A as if it were B.

I would use the term *analogy* for cases in which the characteristics of B and the way that A and B correspond are meant to be obvious and thus the readers know what B means they are supposed to think about A and which aspects of A. If asked, the writer could make everything explicit.

Example: Just as the earth revolves around the sun, an electron revolves around the nucleus.

I would use the term *metaphor* for cases in which the associations that B has, which the metaphor carries over to thinking about A, can vary among readers and go beyond what the writer had in mind. The characteristics of B and which aspects of A and B correspond are not so obvious.

Example: A gang of boys is like a pack of wolves.

Whether an expression serves more as an analogy or a metaphor may depend on the situation, that is, the writer and audience.

Example: What a general is to an army, a CEO is to a company.

(The three examples come from http://fos.iloveindia.com/analogy-examples.html, a site purporting to give examples of analogies. See, in the next chapter, more discussion of metaphor and its use in science and in interpretation of science.)

Metaphors of Coordination and Development

1. Introduction

- Until the 1920s, biological inheritance had much broader connotations than transmission of something discrete (which we now call genes). It also included development. After all, when it is said that a person resembles their parent, two aspects of the transmission of traits to offspring are being raised: how does an offspring develop to have the trait in question at all, e.g., its eye color, and how does the outcome of the development at some point in the lifespan differ from that person to the rest of the family or population. What, then is the relationship between the study of development and the study of difference? What is the role of genes in both? Competing answers to these questions are evident in the contrast between the work of Just and Goldschmidt in the early decades of the twentieth century.
- Interpreting the work of Darwin has introduced the role of metaphor in scientific theories and their presentation to an audience. The account by Gilbert of Just versus Goldschmidt revolves around his interpretation of the metaphors underlying their work.

1b. Mini-lecture

- Multiple views of heredity in the early 1900s.
- Begin the exercise of explaining to aliens how offspring come to resemble their parents.
- Metaphor; metaphors in science; metaphors in interpretation of science.

2. Reading and other Preparation

- Review Gilbert, "Animal development," to inform or remind yourself of the processes by which an egg grows and changes form as an embryo.
    - (Morphogenetic development is not emphasized in biology education. The emphasis is on genes getting switched on and off.)
- Complete the exercise of explaining to aliens how offspring come to resemble their parents.
    - (This is difficult to do without phrases and metaphors that beg for explanation themselves.)
- Read Gilbert, "Cellular politics," in which Gilbert describes the different views of heredity espoused by Just and Goldschmidt.
    - Draw up a chart summarizing the different views of heredity espoused by Just and Goldschmidt. Note, in particular, what controls what and how coordinated action of the different parts of a cell and organism are achieved.
    - Think about these questions to prepare for class discussion: Gilbert sees a correlation between the scientists' social position and their actual scientific research. How could social position influence actual research even if the scientists were consciously trying to build in their social position? Does Gilbert's interpretation devalue the science done by these scientists?

- Read Lakoff and Johnson, "Concepts We Live By," on metaphors.
- Take a quick look at software or http://www.math.com/students/wonders/life/life.html on the Game of Life. If the applets on these sites do not work, google game of life and the name of your browser (e.g., chrome) to find a working version.

3. Activities

- Use the Game of Life to explore analogies with principles of biological development (see below).
- Invent alternative metaphors of or analogies to embryological development that do not rely on a central controller but capture the ability of the organism to co-ordinate its own differentiation and change and thereby make itself.
    - (Build on discussion of inheritance to aliens exercise. Students in the past have described, for example, improvisional dance, cheese making, and a casual conversation in an elevator. When compared with the popular metaphors of DNA as code, there is lack of familiar phrases about development that depict or explain coordination of complex developing parts.)
- Discuss Gilbert's interpretation of the different views of heredity espoused by Just and Goldschmidt.
    - (See questions under #2.)

Game of Life as "Game of Development"

Warm-up Exercises

1. Begin by setting up a random screen (on software or alternative) and watching it until it stabilizes. If it doesn't stabilize after many cycles stop it. Note the different forms you have at the end and their approximate relative frequencies.

2. Play around with the controls, freezing the game, adding and subtracting pixels, changing the speed and resolution, until you have a feel for how to run the software.

3. Clear the screen, set up an R- Pentomino and watch it develop. Freeze it after one minute and note the relative frequency of different forms. Let it go, stop after some more cycles, record, and so on for more cycles.

4. Start again with an R-Pentomino but perturb it, the first time by adding or subtracting a pixel connected to the form before it starts; the next time doing the same but after 2 moves; the next time after 4 moves.... until you've seen all you want to see and made observations which match the principles of development listed below. You will need to begin at slow speed to be able to count the moves and to stop the game after the right one. You may have to choose a different initial form (other than a R-Pentomino) -- keep it simple -- to illustrate some of the principles.

Principles of embryological development

For each principle below make notes to yourself of the circumstances in the "Game of Development" which you observed that match. Imagine also that changes in the initial conditions correspond to

mutations or recombinations and any changes after a run starts correspond to some environmental change, e.g., contact with a teratogen.

1. Local rules, here interactions between neighboring pixels, can lead to integrated, stable morphologies on a large scale.

2. Local rules can lead to order arising out of initial disorder.

3. Mutations or recombinations can sometimes have no effect, sometimes lead to obliteration of morphogenesis, and sometimes lead to novel, stable morphologies.

4. Changes in the environment can sometimes have no effect, sometimes lead to obliteration of morphogenesis, and sometime lead to novel, stable morphologies.

5. The effect of mutations/ recombinations can be quite unpredictable.

6. Perturbations early in development usually have a more severe effect than perturbations later in development. Find an exception in the game.

7. Interactions between cells can produce patterns of cells on a larger scale than the original cells that were interacting.

8. Simple starting shape leads to a range of final shapes (= differentiation during development).

9. Some shapes are way-stations that are obliterated by later developments.

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4. Synthesis and extensions

A. Sapp

Precis TBA

B. The “Game of Development” variant of the Game of Life (involving cellular automata) asks students to find analogs to observations in embryology and developmental biology that render plausible an alternative picture to genes controlling development:

- The organism is a composite of coherent processes.
    - Changes, e.g. produced by mutations, can yield significant (or trivial) but still integrated change in the organism.

- Development is a complex process of structures arising out of structure, and so
  - a change in genes does not necessarily imply a change in some characters.
  - a change in genes can sometimes result in a discrete change in some characters.
- Although development is complex, this doesn't imply the need for a controlling center. Local rules of interaction can yield larger scale co-ordination.
  - Development of social characters will be similarly complex and difficult to tie down to genes, but even more so because
- a) post-embryonic development involves more extensive interaction with the environment and
- b) social characters involve interaction among individuals.

C. Notes on ways that metaphors can be analyzed in scientific writing: http://www.faculty.umb.edu/peter_taylor/metaphor.html

- "[W]hen we search for new concepts and metaphors, or more generally, use words and text to make arguments and seek to convince others, we privilege three related and persistent 'meta-metaphors': '1) metaphors are root, fundamental, underlying things that shape the surface layers; 2) mental things—thoughts, expectations, what we see—shape our actions; and 3) culture or society get into these thoughts (and so we can be taught [or argued into] how to conceive/perceive the world'... These meta-metaphors discount our experience of thought being constructed in practical activity from diverse resources." (Taylor 2001)

5. Connections and resources

Gilbert, S. F. and A. Fausto-Sterling (2003). "Educating for social responsibility: changing the syllabus of developmental biology." Int J Dev Biol 47(2-3): 237-44.

- Two different approaches to reworking a developmental biology course so as to address biology-in-society.

Oyama, S. (2001). Terms in tension: What do you do when all the good words are taken? Cycles of Contingency: Developmental Systems and Evolution. S. Oyama, P. Griffith and R. Gray. Cambridge, MA, MIT Press: 177-193.

- TBA

Taylor, P. J. (2001). Distributed agency within intersecting ecological, social, and scientific processes. Cycles of Contingency: Developmental Systems and Evolution. S. Oyama, P. Griffiths and R. Gray. Cambridge, MA, MIT Press: 313-332.

- "In a 'section of Susan Oyama's The Ontogeny of Information on 'Subjects and Objects.' Oyama describes our primary experience of ourselves as subjects maturing from dependence and passivity to independence and control—what I call 'concentrated' agency. We come to experience temporal

continuity, casual potency, and are able to impart order according to prior knowledge and plan. This experience, however, 'exaggerates our role as detached subjects and denies our object-like status' (Oyama 1985, 76). Accordingly, when we try to explain development, interaction, and perception, we tend to posit another subject inside ourselves—mental modules, optimizing or rational actors, or, most notably, genes. Similarly, to explain the order of the world people have traditionally posited a subject outside it, God, or, more recently, 'the-forces-of-natural-selection.'

- In order to develop better explanations of development, interaction, and perception, we need, Oyama implies, metaphors and concepts that do not rely on the dynamic unity and coherency of agents, or on superintending agents within or outside those agents. And, to the extent that such patterns of thought persist because of their resonance with the experience agents have of their relations and actions in the material and social world, we need different experience. Or, better, we need to highlight submerged experience of ourselves as 'object-like' or 'distributed,' that is, as agents dependent on other people and many, diverse resources beyond the boundaries of our physical or mental selves. After all, the primary experience of becoming an autonomous subject is not 'raw' experience, let alone uniform and universal experience..., but experience mediated through particular social discourse.
- There are circles here to be wrestled with. New concepts and metaphors might emerge if we experienced ourselves differently, but what counts as our primary experience is mediated by prevailing conceptual schemes and shared metaphors. And in current Western social discourse, these highlight our autonomy as subjects. Conversely, when some of us seek to theorize Developmental Systems or, in my case, to highlight distributed agency, we foresake the facilitation afforded by prevailing concepts and metaphors of concentrated agency. To so distance ourselves from the dominant discourse, however, requires a strong sense of 'independence' and 'causal potency' in attempting to impose an order—on one's world and on one's audiences."

5b. Add to this blog post to make contributions to the revision of the chapter above or to an annotated collection of readings and other resources related to the chapter.

5c. Adaptation of themes from the chapter to students' own projects of of engaging others in learning or critical thinking about biology in its social context: Suggestions for how to do that:

i. Identify an idea that is central to your project area, e.g., balance of life, and invent an activity that leads your audience to explore the complexities of associations that the term might have once one starts probing it.

ii. Identify a theory that is central to your project area, e.g., genetic coding, and invent an activity that leads your audience to explore its history, noting especially the contrasting theories that have been held.

iii. Adapt an existing game so it illustrates ideas related to your project area that are difficult to visualize or to experience.

Inheritance for aliens

Imagine that humans have established communication with beings from another planet that neither age nor reproduce. Your task is to draw diagrams or schemas that convey to them how your parents contributed to you having the height or intelligence you have at 20 or so years. (The aliens have learnt English so you can use words on your diagrams.) The explanation conveyed in your diagrams or schemas might include genes, DNA, gene expression, embryology, environmental influences on your growth and development, and so on. Try to help the aliens by identifying what is left unexplained.

These beings are very intelligent themselves and are also scientific skeptics. If there is a hole in your explanation they will find it. You might want to preempt them by marking where you feel you need to find out more about how human inheritance works. You should also note that these aliens have received some information previously that emphasized meiosis and formation of the single-cell zygote. In return, they commented that zygotes have no height or intelligence and re-emphasized that they want to know how offspring get to have a height or intelligence similar (or not) to their parents.

The aim of this exercise is for you to think through something often avoided in biology, namely, the limitations of what most biologists actually know and don't know about inheritance.

After you have tried this for yourself, review some phrases students used in a past class.

Metaphor Notes, Peter Taylor

Contents

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1. Notes on readings, made with a view to stimulating discussion and clarification
February 1996

The selection of readings is a small sample of the published literature, but enough to highlight the two meta-metaphors I see in Stepan and begin to articulate what's missing, what needs to be worked on, what I'd like to discuss with others. [Material in brackets is my interpretation and commentary]
After my reading notes I attach i) a brief sketch of where I am trying to push things; and ii) an overview I composed to help me sort out what to say to my undergraduate class when I discussed natural selection as a metaphor.

Stepan, N. L. (1986). "Race and gender: The role of analogy in science." Isis 77: 261-277.

[Her meta-metaphors are
1a) metaphors are root, fundamental, underlying things that shape the surface layers; which is related to
1b) mental things -- thoughts, expectations, what we see -- shape our actions; and
2) culture or society gets into these thoughts etc. -- we can be taught (see Gilman quote) how to conceive/ perceive the world.
These are not winning meta-metaphors for me, given my idea that all action and thought is constructed in practical activity from heterogeneous resources.]

Danzinger, K. (1990). "Generative metaphor and the history of psychological discourse," in D. E. Leary (Ed.), Metaphors in the History of Psychology. Cambridge, Cambridge University Press, 331-356.

Metaphor = phenomenon of thought as well as speech.
Repeated metaphors reveal patterns of thought.
Patterns allow us to analyze underlying assumptions and preoccupations.
[Note here the slippage from pattern to locus of causality in line with Stepan's meta-metaphor 1. In fact, later on...]

Metaphors tend to be hidden and not expressed in a single term, but "underlie the discourse as a whole." Also: "basic metaphor" "underlying cognitive schema" (p. 338)

Openness allows both coherence (communication within a common framework) and difference in emphasis, including difference evolving over time, i.e., novelty.
Novelty is to be expected given
i) metaphors are extended, i.e., terms are part of reticulating networks of implications; and
ii) Black's interaction theory of metaphor (both terms influence the meaning taken by the other)
Together i) and ii) mean metaphors bring "together systems of implications [entailing] the likely formation of new connections" (p. 334)

[Notice that the interest in novelty does not extend to asking which novel metaphors are taken up and become part of discourse.]

Novelty and on-going evolution of systems of implications of a metaphor means that we cannot be sure a term at time t and at time t+T refer to the same thing. We need to locate the terms in the discursive systems of their times.
[Note the dichotomy: meaning by reference or meaning within context of discursive system.]

The discursive system involves the functioning of any analogized artifact in a particular social organization. Following Schön (see below), metaphors invite us "to act in terms of certain implied assumptions" (p. 351).
[I like this emphasis on acting as if. One's ability to act as if could explain which metaphors are taken up and which are forgotten (see above). But Danzinger closes off this line of inquiry before it has a chance to get anywhere...]
Activity takes place within forms of life, "'practical actualities'... 'whose significance goes without saying'" (citing Toulmin)
[This the agent may act as if, but this is generated not the effectiveness of one's acting as if, but by who the agent is. Forms of life imply some socialization process, so we have here another case of Stepan's meta-metaphor 2.]

Lakoff, G. (1993). "The contemporary theory of metaphor," in A. Ortony (Ed.), Metaphor and Thought. Cambridge, Cambridge University Press, 202-251.

[like Danzinger] locus of metaphor not in language, but in thought, in "cross-domain mapping[s] in the conceptual system' (p. 203).
"everyday behavior reflects our metaphorical understanding of experience" (p. 204)
"Is there a general principle governing (the mappings)?" (p. 206)
[Note empirical regularities and commonalities are taken without questioning to be governing or generative. See similar note on Danzinger.]
Answer: Yes, it's "part of the conceptual system underlying English" (p. 206).
[Stepan m-m 1 again]

Reddy, M. (1993). "The conduit metaphor: A case of frame conflict in our language about language," in A. Ortony (Ed.), Metaphor and Thought. Cambridge, Cambridge University Press, 164-201.

Reddy, a linguist, chronicles many, many variants in the English language of the conduit metaphor for communication of ideas between people. Against this he proposes a "toolmaker's paradigm," which highlights and valorizes the efforts of the listener in shaping the outcome of communication. "Partial miscommunication, or divergence of readings from a single text, are not aberrations. They are tendencies inherent in the system [of communication], which can only be counteracted by continuous effort and by large amounts of verbal interaction" (p. 175).

Because "language influences thought processes" (p. 173), the conduit metaphor in English suppresses the effort or awareness of the effort.
[Actually, language governs thought processes for Reddy (like Lakoff). The toolmaking image is not an invitation to examine the relationship of material practices to thought. Reddy doesn't explore these implications of his metaphor. "Effort" is equated to verbal interaction.]

Gergen, K. J. (1990). "Metaphor, metatheory, and the social world," in D. E. Leary (Ed.), Metaphors in the History of Psychology. Cambridge, Cambridge University Press, 267-299.

"metaphors... advance understanding of social life" "...generate... theoretical developments" (p. 267) "pervad[e] social psychological theories" (p. 294) [i.e., Stepan's m-m 1]

As a metaphor "gradually becomes incorporated into the communal practices and as the new patterns become solidified, the term will become increasingly literal." (p. 270) [Gergen is a social constructivist in the Berger & Luckmann sense...] A new metaphor is only partly intelligible and acceptable, but becomes more so an an "outcome of ongoing interchange among persons" (p. 271). "[M]eaning is derived from an array of patterned practices within varying contexts" (p. 270) -- which he see as an extension of Wittgenstein's language games as context in which terms have meaning.

[Note that he hasn't addressed what influences whether a metaphor will be taken up and become part of the "ongoing interchange" and "communal practices." The extended Wittgensteinian formulation means that culture/ society/ forms of life/ patterned practices precede thoughts, i.e., Stepan's m-m 2.]

Schön, D. (1993). "Generative metaphor: A perspective on problem-setting in social policy," in A. Ortony (Ed.), Metaphor and Thought. Cambridge, Cambridge University Press, 137-163.

[Danzinger cites Schön's essay when he says metaphors invite us "to act in terms of certain implied assumptions." But I read Schön as following the model of thought generates action,

but where the thoughts/ metaphors he concerns himself with are the subset related to dominant social policies.]

Metaphor is central to framing and generating new perspectives, to "seeing as." Generative metaphors underlie stories and through stories problems (e.g., in social policy) are framed or set. Frame restructuring requires new metaphors and stories. [Stepan's meta-metaphor 1 again.]

Two puzzles:
i) Interpreting thinking from what is said and done [i.e., what is said and done follows from what is thought]. Deep metaphors need to be exposed in order to understand surface ones, to see what is assumed, excluded, included, and to understand why policy framings can be incommensurable. Critical interpretive work can help lead to frame-restructuring [but see the end of my note on ii) below].;

ii) What is involved in generativity.
"A situation may begin by seeming complex, uncertain, and indeterminate. If one can once see it, however, in terms of a normative dualism such as health/disease or nature/artifice, then we shall know in what direction to move" (p. 148). Achieving this is the hallmark of a generative metaphor.
[Note the collapsing going on here. While generativity could be defined in terms of qualities of the metaphor, Schön evaluates generativity in terms of the outcome, i.e., people knowing what direction to move. He slips in the proposition that discursive reduction of complexity is needed for people to get their direction clear (which overlooks questions about how people are rhetorically enrolled through discursive reductions and about whether simple models contribute to the problem of constrained policy-setting). Furthermore, Schön's generative metaphors are actually a subset of those that reduce complexity and point to a direction to follow, namely those that underlie the dominant policy framings.
Given this collapsing, it's not surprising that by the end Schön has only got to the point of posing the question of what facilitates frame-restructuring work -- there's little in the essay that would help us address it. And given his adherence to the framework that action follows thought, it's not surprising that he envisages this as "cognitive work" (p. 160).]

Yanagisako, S. and C. Delaney (1995). "Naturalizing power," in S. Yanagisako and C. Delaney (Eds.), Naturalizing Power: Essays in Feminist Cultural Analysis. New York, Routledge, 1-22.

[This essay is not directly about metaphor, but it employs Stepan's meta-metaphors.]
"differentials of power come already embedded in culture. That is what we mean by naturalizing power, for power appears natural, inevitable, even god-given" (p. 1)

[Too much ground is conceded here; the propositions need more precision. Consider:
i) How does culture operate so that people have the idea that only if something is not culturally- or socially-generated (i.e., is natural or god-given) it is inevitable?
ii) What is the model implied in the "embedded" metaphor? Answer: A person cannot refer to

something not permitted in the existing system of inter-references, which, e.g., exclude power as something socially generated. Is this a plausible model of thought and verbal expression?

Although in the essay Y&G acknowledge that things are both real and discursive, their anchor is that culture, a system of rules and meanings, determines what meanings can be readily established, or, teasing this open a bit: culture -> an agent's subjectivity -> their thought -> action (Stepan's m-m 2). The metaphor of embedded, underlying, etc. then make senses as well (Stepan's m-m 1).
It seems to me that in Y&G culture-given as inevitable is the analog of god-given and natural as inevitable. Given that Y&G's book is feminist cultural analysis, inevitability might seem to work against their purpose. But, maybe not, because it simplifies their self-positioning. (This point needs discussion.)

Excerpt from "Shifting positions for knowing and intervening in the cultural politics of the life sciences," draft afterword for Changing Life: Genomes-Ecologies-Bodies-Commodities (U. Minnesota Press, 1997).

From mental and verbal images to "acting as if" as meta-metaphor

Agents, whether working as scientists or cultural interpreters, draw upon a sense of what the material and social world is like. Interpreters observing this "likening" try to convey what it is like. Sampling from Haraway's work, agents are involved in: noninnocent conversations using visualization technologies; holding partial perspectives; situated knowing; story-telling; embodied vision; worldly diffraction; viewing the doings; materialized refiguration. Notice that all but the last term connotes the making of mental and verbal images; images that we believe or think the world is like, or that we speak or write as if it were like. In general, likening is taken to mean having an image that corresponds to the world. But there is another sense of likening that parallels the first shift in our basis for knowing and intervening: we also *act as if*. In fact, while viewing, speaking, and thinking are indeed actions, they are particular kinds; "acting as if" could be viewed as a more inclusive "meta-metaphor" of likening.
In this light, we would seek to learn what is at stake in any representational or discursive work. What is it that the agents are trying with their ideas to do something about? Moreover, what needs to be done practically in order to modify their moves? Following this line of questioning, the activity of scientific and interpretive agents can be interpreted as richly metaphorical in the more inclusive, "acting as if," sense. To choose one example... Yes, global computer modelers think that human activity forms a system to be managed, but more importantly, their categories, tools and social positioning jointly enable them to act -- in actuality or in powerful fantasies -- as if they were the planet's managers. Or, if not the managers, their close advisers.

Notes for teaching, as revised in Fall '95 (i.e., before I completed the readings above)

In literature
A poet uses "inferno" to describe a fire, evoking in the reader **associations** such as inferno =

hell, death, worse thing possible, out of the benevolent God's control, etc. A fire is not **literally** the inferno, but because the reader has strong associations with infernos, this **stirs up their thinking** to think of it **as if** it were the inferno. Gradually this metaphor has faded -- in part, I suspect because hell no longer evokes such strong associations -- and inferno is now used to describe any severe fire (it has become a cliche), and the metaphor may eventually die*, e.g., "raging fire" means a fire that is unchecked and hardly evokes a person (or god) in rage. The process is never, however, even; metaphorical associations are always **open**, that is, they are
-not specified by the writer/speaker;
-differ from reader to reader; and
-differ for any reader according to circumstance.

In language
Meaning by reference is contrasted to meaning by associations
dictionary thesaurus
atomized* web-like, network
specifiable open

In philosophy
There have been many big (protracted, convoluted, jargon-full) debates about meaning and reference, which led to/ carried over into analysis of metaphor. One useful idea, which I associate with Max Black, is **reciprocal animation**. If we use the metaphor inferno to animate* our thinking about fires, then we also animate our thinking about hell by thinking of it as if it were like being inside, burnt by, as hot as, as noisy as... a severe fire. We can refine Black's insight if we note that there is usually some lag; the secondary animation (fire as a metaphor for hell) develops over time.

Development of metaphors over time (PT):
Step 1: (Carrying over/ As if/ Animation) Metaphor B (= Name B + Associations of B) animates thinking about phenomenon A. The "carrying over" changes associations of A -> associations' of A. The animation relies for its impact on A being not literally B, and on B being part of a network of associations (which includes other metaphors).
Step 2A (Dead metaphor): Name B is still used to describe A but no longer evokes the associations of B, or, at least, not so strongly.
or
Step 2B (Reciprocal animation): Some of the original associations of A are carried over to B so that associations of B -> associations' of B. With time the effect may be less one of stirring up and more one of infusion.
Step 3B (Collapsed metaphor): Reciprocal infusion continues; the difference in associations' of A and associations' of B diminishes; and the Name B may carried over to A, resulting in a new composite, AB. The non-literalness of A's likeness to B is now elusive, and pointing it out is apt to be confusing unless the original context of use is evoked well.
Step 3A/4B (Displaced metaphor): Dead and collapsed metaphors can gain associations from elsewhere; e.g., "toe the line" died and became reborn* as "tow the line."

For example, when Darwin used Natural selection to describe a mechanism of evolutionary change capable of producing adaptations, he was playing on connotations both of selection by humans of plant and animal varieties and of Nature being like a superintending God (so that it could intentionally rank and select). The metaphor was striking because he was saying that there was not literally a selector in nature using some selection criterion, but the result could appear as though there were. Nowadays when selection is intentionally performed in society, e.g., by educational testers, the ranking* seems to be follow a principle given by nature, not merely a social convention (reciprocal animation). Moreover, biologists now talk about the environment being an agent of selection or a selective force, that is, agency, selection, and application of force do not have to be intentional, and the term for evolutionary generation of adaptations is now natural selection (collapsed metaphor). Biologists often use the term natural selection even when they have not identified a character that conferred the survival and reproductive advantage, that is, have neither an intentional agent nor a "selection criterion," and so, to some extent, it is also a dead metaphor. And Elliott Sober, a philospher of biology, has developed a complete analysis based on thinking of natural selection as a force (displaced metaphor).

The questions left open by this description of development over time are:
i) what influences whether a metaphor gains currency*?; and
ii) what motors* the changes?
The difficulty in answering these questions is related to the complexity of reticulating* networks of associated metaphors (see steps 1 and 3A/4B).

In science studies analyses
a) Dominant metaphors of one's time **organize one's thinking** in general, and in science in particular, so that a scientist's theories and texts are structured* (in part?) by the metaphor, e.g., progress, development.
b) Metaphors are **rhetorical resources** used **to move*** different audiences (recall the openness of metaphors) to entertain new ideas.
c) Metaphors **crystallize*** (but not fully) something that had been difficult to see*, but that people were ready to speak about if given a suitable image, e.g., natural selection, "look back in anger."
d) (PT) Metaphors are powerful to the extent that they contribute to the social circumstances allowing the user/receiver not just to think as if A were like B, but to **act as if** A were like B. Eventually, this acting as if may collapse the metaphor (see above).

Explanatory phrases from the inheritance-to-aliens assignment
(underlined phrases are metaphors themselves)

Individuals are born with characteristics from their parents
Paired chromosomes made up of genes determine all of the offspring's characteristics
From infancy a gradual metamorphosis occurs
Combinations of genes determine height; the environment plays a large role
Humans do not inherit characteristics; they inherit genes = possibilities
Humans are ultimately made up of genes
Genes control the biological and developmental aspects of human life
genetic material propagates itself
differentiation is controlled by chemical coding
genes are ultimately responsible for most characteristics
height is a genetic trait, inherited from one's parents; environment may have some influence
genes are composed of information, the basic formula for cells
genes compose the internal environment of humans
the genetic formula contains a program of the developmental process
Biological factors inherited from parents combine with developmental and external factors
DNA codes for specific proteins
genes are the units of inheritance at the cellular basis
genes are the fundamental basis of development
maximum potentials lie within the chromosomes
external insults limit the full expression of intelligence
genetics determine the capacity
capacities have been passed on to me
genetic material contributes information which determines the offspring's makeup
genes are responsible for the initiation and direction of development
genes code for proteins which stimulate development
the environment merely delimits how genes will be expressed
the nucleus is the control center of the cell
genes = information determine characteristics
DNA = inheritance link
genes = raw material inherited
the zygote undergoes billions of cell divisions to become a baby
intelligence may be strictly due to genetic processes; the environment may act by
turning genes on and off
genes determine some specific characteristic
cells arrange themsleves in a pattern
sperm/ egg contain all the information necessary to build another male/female
genes carry the information
genetically transferred
inherit genetic potential; expression depends on environmental factors
genes code for traits
an individual is a product of a set of instructions of a program
dissect the complex relationship between nature and nurture

What causes a disease? The consequences of hereditarianism in the case of pellagra

1. Introduction

- The causes proposed reflect the social actions desired or supported given that
  - the categories used (and thus data collected)
  - assumptions needed to make causal claims from patterns
    - are places where social assumptions can influence the scientist's decision, and
    - science cannot be done without decisions in these areas
- When people make explanations, you may look at how they attempted to identify or locate the causation and consider alternative styles of causal explanation. If a scientist is emphasizing, say, a unitary cause, consider the multiple factors they are excluding.
- This approach will help you raise questions about the other commitments that influence their choice of questions, categories, factors, and admissable explanations. The causal explanation that is advanced often corresponds to the person's commitments to certain forms of social action, e.g. Galton (Darwin's cousin) didn't measure any environmental variables and was thus able only to reach conclusions about (supposedly) inborn characters; Davenport and others similarly denied the significance of Goldberger's experimental evidence for dietary basis of pellagra.
- Identification of more proximate causes (e.g., a lung cancer gene) is not necessarily needed to ensure the most effective action (e.g., we can encourage people to stop smoking independently of knowing the genetic mechanisms of lung cancer).

1b. Mini-lecture
Review of beriberi case and introduction to pellagra, focusing on
Styles of causal explanation and their relation to ideas about politics and social action (themes and schema)

2. Reading

Chase, A. (1977). "False Correlations = Real Deaths," in The Legacy of Malthus. NY: Knopf, 201-225. (precis below; full chapter in password-protected readings.

- Identify the different notions about the cause of pellagra and any assumptions you can see underlying those notions.
- Identify or speculate about the actions favored with respect to pellagra by the different people or groups of people Chase describes.
- Take notes to enable you to assume either Goldberger's or Davenport's scientific and social position and convince people to take some action on the basis of what he believed about pellagra and about society.

- Make notes on questions you would investigate to help you make your case if you were asked to support or dispute this proposition: "Goldberger's discovery could not prevent pellagra in the 1910s and 20s in the United States, but could in the 1930s."

Chase, Allen. (1976). “A Few False Correlations = A Few Million Real Deaths: Scientific Racism Prevails Over Scientific Truth.” The Legacy of Malthus. The social costs of the new scientific racism. New York, Knopf.

Misdiagnosed for centuries as leprosy, scurvy, syphilis, and other diseases marked by rough red skin eruptions, pellagra was described by the Spanish physician Gaspar Casal in 1735 as a distinct disease that he called mal de la rosa (the red disease). It was, in each country, a disease of the very poor, in which the skin eruptions were followed by debilitating sequences of diarrhea, lassitude, dizziness, and various mental disorders ranging from depression to violent lunacy.

In 1906, George H. Searcy, a southern physician, discovered many cases of pellagra among the inmates of the Mount Vernon insane asylum in Alabama. Doctors and public health officials started to seek out non-institutionalized cases of the red disease and soon realized that pellagra was endemic throughout the poorest section of the nation, the southern states. By 1908, various states had established pellagra commissions, and a new National Association for the Study of Pellaga held the first of its annual scientific meetings devoted to reports and discussions on the causes and management of the new plague.

A major treatise by Dr. Edward Jenner Wood in 1912 revealed that “the cause of pellagra is still unknown…” although there abounded a number of hypotheses at that time. Throughout medical literature, however, there was one constant thread of evidence suggesting that pellagra was caused by the inadequate diets of poverty and that in the presence of enough food, the disease never struck. Although he reviewed many of the early European authors who had written about pellagra and diet, Dr. Wood remained resistant and wrote that, “I can deny that bad nourishment in the sense of insufficient nourishment is a cause.”

In 1912, a Pellagra Commission was established under the auspices of the New York Post-Graduate Medical School and Hospital, initially under the direction of Joseph F. Siler, a physician with the Army Medical Corps, and Philip E. Garrison, a Navy surgeon. The following year, Dr. Charles B. Davenport (a zoologist by training) from the Eugenics Records Office in Cold Springs Harbor, New York, joined forces with the Commission with the intention to study pellagra from the viewpoint of heredity as a causative factor. Around the same time, due to the continuing social and economic problems caused by pellagra (disease-caused absenteeism in the textile mills; the loss of European markets for American corn due to the mistaken belief that corn was responsible for the disease), the Surgeon General of the United States

appointed bacteriologist Joseph Goldberger of the U.S. Public Health Service to discover the cause and cure for pellagra. Coming from an impoverished immigrant family background himself, Goldberger had a greater insight into the total environment of poverty than did Siler or Garrison. He, too, set up his fieldwork in Spartanburg, South Carolina, where Siler and Garrison were working, but he took the time to travel around the district, visiting the insane asylums, the orphan asylums, mill towns and rural slums where pellagra was rampant. He noticed two things: that whenever there was great poverty, there was pellagra, and that the better off employees of the prisons, asylums, or mills never developed a single case of pellagra. Although the disease had been known about for far longer than other diseases, pellagra was possibly never considered within the ranks of the great plagues such as malaria, yellow fever, or typhoid because it struck only the poorest.

Goldberger set out to prove his hypothesis that pellagra was not a communicable disease, but was instead caused by the lack of an unknown vitamin which he called the PP (Pellagra Preventative) factor – as well as meats, poultry, fish, dairy products, fruits and vegetables in the diet. He conducted a number of famous experiments in Mississippi with volunteer white prison inmates in whom he first induced pellagra by withholding and then cured them by re-introducing meats, vegetable, and eggs into their diet. In another dramatic experiment, Goldberger, his wife Mary and his assistant Dr. G.A. Wheeler injected themselves with biological materials from pellagrins consisting of blood, vials of skin scrapings and ingested little dough balls impregnated with the urine and feces of the patients.

The publication of Goldberger's report on his Mississippi experiments came as something of a blow to the Pellagra Commission in which Siler, Garrison, and Dr. Ward T. MacNeal were working. At the same meeting where Goldberger and his colleagues reported their findings, MacNeal offered his report, which identified lack of plumbing and sewerage as the culprit in pellagra. Goldberger pointed out that the relationship of pellagra to sewerage might be a case of "false correlation" since the well-to-do [and better fed] had the sewers in the town and the poorest [undernourished] citizens lacked plumbing and sewerage. His argument was dismissed by MacNeal who proposed that the analysis of mass data by statistical correlations – a method adopted by Davenport – was preferable to just "theorizing" about the data.

Despite the convincing case made by Goldberger for a diet-related cause to pellagra, the mortality figures for the disease continued to rise in the years following his discovery. Among the several reasons for this disappointing result, one stands out: the efforts by Charles B. Davenport to correlate the incidence of mental deficiency and insanity associated with pellagra to his view that pellagra was an inheritable disease. Davenport's thesis was that pellagra was "the reaction of the individual to the poisons elaborated in the body, probably by a parasitic organism." To reach this conclusion, he also had to explain that although pellagra was not an inheritable disease in the sense that brown eye color was

inheritable, the course of the disease did indeed depend on certain “constitutional, inheritable” traits of the affected individual. “Susceptible” parents would produce children who were also susceptible to the disease.

Davenport and Elizabeth Muncey, M.D., published an article on the hereditary causes of pellagra in the Archives of Internal Medicine. Subsequently reprinted as a Bulletin of the Eugenics Record Office, it made a third and final appearance in the final report of the pellagra Commission. In this report, Davenport and Muncey presented their detailed tables and pedigree trees (the ‘black charts’ of eugenics) that purported to establish their view that pellagra was a hereditary disease. These pedigree charts only succeeded in proving that the children and grandchildren of poor people [would] quite predictably suffer the socially preventable deficiency diseases of poverty. The size (444 pages), scientific complexity, and ‘authoritative’ tone of the Davenport report combined with the low standard of medical education that produced physicians who did not have the capacity to question the report’s veracity, meant that most accepted the conclusion that it was “bad genes” and not “bad diet” that was responsible for pellagra.

Society, specifically the public health policies in society, was thus let off the hook in terms of acting to increase the living standards generally among the working poor. The excuse for doing nothing to improve the economic opportunities of the poor in the South which, in turn, would have allowed people to earn enough money to adequately feed themselves and their families – was justified by the ‘inborn inferiority’ of the poor. Ironically, it was not until the Great Depression when the government started disbursing food and welfare funds to save the lives of all people rendered hungry and helpless, that Goldberger’s pellagra prevention factor was able to protect all classes of people.

The Great Pellagra Cover-Up fro 1916-1933 was the result of “scientific racism.” Had Goldberger’s findings been acted upon, millions of completely avoidable premature deaths, chronic degenerative diseases and other disorders known to be associated with chronic undernourishment could have been avoided. Such was the missed opportunity that benevolent social action should have had on the clinical reactions to malnutrition.
(Precis by Jan Coe)

3. Activity

- Use themes and schema to review the different notions about the cause of pellagra, assumptions underlying those notions, and the actions favored with respect to pellagra by the different people or groups of people Chase describes.
- Take the role of Goldberger or Davenport to convince others to act on your scientific account. (Students randomly assigned to one role or the other.)

- (Time permitting) Discussion of questions you would investigate to help you make your case if you were asked to support or dispute this proposition: "Goldberger's discovery could not prevent pellagra in the 1910s and 20s in the United States, but could in the 1930s."

4. Synthesis and extensions

TBA

5. Connections and resources

Harkness, J. M. (1996). "Prisoners and Pellagra." Public Health Reports 111(September/October): 63–467.

- Goldberger is the hero in Chase's chapter. Harkness makes us think about a dimension of Goldberger's work not highlighted by Chase. How does it affect you to see that dimension if it had not concerned you before reading Harkness?

Marks, H. M. (2003). "Epidemiologists Explain Pellagra: Gender, Race, and Political Economy in the Work of Edgar Sydenstricker." Journal of the History of Medicine and Allied Sciences 58(1): 34-55.

- Marks adds additional dimensions to our understanding of research that Goldberger began and was continued by his collaborator Sydenstricker through the 1920s.
- Goldberger, a US Public Health Service doctor who showed the connection between diet and pellagra through observation and experiments with a prison population, also worked with Sydenstricker in the mid-1910s to show the association in data derived from 7 mill towns in S. Carolina. The association was clear against income per adult male equivalent (with nutritional needs of wives and children set lower). They did not go beyond this statistic to examine distribution within households and shed no light the higher incidence of pellagra among women. In subsequent work on sharecroppers and tenant farmers in Mississippi, Sydenstricker examined the annual and debt-related restriction on food supply but made no distinction between whites and blacks and shed no light on the disproportionate incidence of pellagra among blacks. Marks concludes that, by distracting attention from gender and racial inequalities, "research methods and traditions, no less than overt ideologies, played a role in maintaining the subordinate social position of women and African-Americans in the southern United States" (p.34). There is more to Marks' account, including the more pluralistic idea of race in the areas of high immigration in the industrial Northern USA and access to fresh foods in some villages but not the strict mill towns.

5b. Add to this blog post to make contributions to the revision of the chapter above or to an annotated collection of readings and other resources related to the chapter.
5c. Adaptation of themes from the chapter to students' own projects of engaging others in learning or critical thinking about biology in its social context: Suggestions for how to do that—

i. Have your audience identify the different kinds of causes and the kinds of actions that would influence those causes (as THINK14 did). Then consider the social position or views of the exponents of different kinds of causes in relation to the different kinds of causes and the kinds of actions that would influence those causes.

ii. Brainstorm with instructor

Styles of causal explanation and their relation to ideas about action

Theme 1:
The causes proposed reflect social actions desired/ supported
because
the categories used (and thus data collected)
assumptions needed to make causal claims from patterns
are places where social assumptions can influence the scientist's decision, and
science cannot be done without decisions in these areas

Theme 2 :
When people make explanations look at how they attempted to identify or locate the causation and consider alternatives/ tensions. If a scientist is emphasizing, say, a unitary cause, consider the multiple factors they are excluding.
This approach will help you raise questions about the other commitments that influence their choice of questions, categories, factors, and admissable explanations. The causal explanation that is advanced often corresponds to the person's commitments to certain forms of social action, e.g. Galton (Darwin's cousin) didn't measure any environmental variables and was thus able only to reach conclusions about (supposedly) inborn characters; Davenport and others similarly denied the significance of Goldberger's experimental evidence for dietary basis of pellagra. Can you identify similar divergences in explanations of causes and proposals for action in the case of other diseases, e.g. cancer, AIDS?

Some tensions:

local/focal , proximate, single factors <---> + certain background factors			synthetic, multiple factors		
/	I	\	/	I	\
assumed I	controlled I	specified & modifiable	non-separable	generally interacting	linked in specific ways
I	I	I	I	I	I
"unitary"	engineering, experimental	"background"	holistic	interactive, synergistic	"constructionist"

-- internal to some object (e.g. each individual person) vs. in the external relations
-- in the present situation vs. in its history

causes exposed by:

some data			+ some assumptions		
I	\		/	I	\
naturally variable observations	experimentally controlled ones		bias	plausible	bits of evidence
I	\				
"false" correlations	good comparative work				

Theme 3:
More proximate causes (e.g., a lung cancer gene) are not necessarily needed to ensure the most effective action (we can encourage people to stop smoking independently of knowing the genetic mechanisms of lung cancer).

How changeable are IQ test scores?

1. Introduction

A continuation of the critical thinking theme of interpreting scientific ideas in relation to the actions favored by the exponents of those ideas is to pose a question that can be asked of all sides: What can we do (on the basis of the science)?

1b. Mini-lecture (interactive)

- Interpreting parent-offspring height patterns
- Interpreting differences in averages for groups

  * The world is not a simple matter of genes explaining anything and everything, especially differences between averages for groups. Be skeptical of anyone who wants you to think it could be simple. (They are not being true to the science of average group differences.) Instead, ask questions—dig deeper into the complexity.

  (Visual aids)

2. Reading

A famous debate occurred around 1970 between Jensen (1923-2012) an educational psychometrician (analyst of psychological data) who believed that IQ was inherited and difficult to change and Lewontin (b. 1929), a population geneticist (evolutionary biologist) who argued that Jensen's method was flawed and who believed that society had not tried very hard to boost intelligence. The reading does not include the original Jensen article in the Harvard Educational Review because it is too long, so you have to discern his arguments from Lewontin's account of them and Jensen's response to Lewontin. Read and unpack their exchange by making up a charts along the following lines, where you add rows for each new point, leave a cell blank if there is no response by the other person, and use "Notes" to record your response to their points, e.g. What convinces you? What don't you understand? (It is difficult material so don't be afraid to say when you don't follow the technicalities.) When you look at the exchange as a whole, consider what political, social or other assumptions are involved in the argument. What actually gets answered and what not?

Jensen's arguments in Lewontin's account	Lewontin on specific points of Jensen's arguments	Notes
e.g., because blacks perform, on average, more poorly than whites on IQ tests, and because compensatory education programs have failed to remove this difference (due to his hypothesis that IQ is genetic), there is no use trying to remove the difference in IQ through education.	.....	.....

		.....

Jensen's (re)view of his own arguments	Notes
e.g., It is necessary to look at individual differences rather than taking it as read that "all children are alike." This could be more fruitful than large scale programs based on a philosophy of general cultural enrichment.	.....

Jensen on the points of Lewontin's account	Lewontin's response to Jensen on his (Lewontin's) account	Notes
e.g., Lewontin's paper has an ad hominem flavor.		.....

Additional questions to prepare for class discussion: Jensen asserts that equal education does not work and that we need education tailored to the individual needs of students. Does he give any evidence that equal education had been attempted in the USA by the late 1960s? Do you know of any such evidence? Who do you think would find his assertion plausible (c. 1970) with little or no evidence given? What is the context that makes this plausible? If you need help thinking about these questions, do some internet investigation.

3. Activity

Review the charts of arguments, counter-arguments, and missing arguments in the exchange
What can we do on the basis of the science of Jensen? Of Lewontin?
Review how this relates to the critical thinking theme of interpreting scientific ideas in relation to the actions favored by the exponents of those ideas.

4. Synthesis and extensions

By unpacking the debate between Lewontin and Jensen, the following themes should emerge:
1. There are no simple explanation about genetics and socially significant traits, especially regarding average racial differences. Therefore: be skeptical of anyone who proposes such an explanation (i.e., scrutinize where they are coming from).
2. There are researchers who have detailed technical cases to make (even if their conclusion is quite simple, e.g., Jensen believes it is plausible that genes account for (average) racial differences). Their arguments can be teased out into their components (in this case, with help from Lewontin, who can handle the technical side and has views about the political/social implications and underpinnings of the science).
3. What can we do (on the basis of the science) is worth asking of all sides. (Jensen thinks we have tried

and failed to equalize education so educate people according to their innate capacities [actually, educate people according to the typological generalization about the average differences between the races]; Lewontin thinks educational professionals have not tried very hard and when society is committed to equalizing education ways will be found.)

Lewontin vs. Jensen debate

A famous debate c. 1970 between an educational theorist (Jensen) who believed that IQ was inherited and difficult to change and a geneticist (Lewontin) who argued that Jensen's method was flawed and who believed that society hadn't tried very hard to boost intelligence (pjt).

Precis (by JanCoe) of Lewontin, R. (1976). “Race and Intelligence (and Jensen's reply, and Lewontin's reply to that).” In The IQ Controversy: Critical Readings, ed. N. J. Block and A. Dworkin. NY: Pantheon, 78-112

Jensen’s arguments in Lewontin’s analysis	**Lewontin on specific points of Jensen’s arguments**
Jensen’s overall argument is that: because blacks perform, on average, more poorly than whites on IQ tests, and because compensatory education programs have failed to remove this difference (due to his hypothesis that IQ is genetic), there is no use trying to remove the difference in IQ through education.	
Since compensatory education has failed, shouldn’t we inquire why that is so?	Jensen’s professionalist bias that makes him take the position that if a problem were soluble, it would have been solved.
IQ tests are culture bound and there is good reason they should be because they are predictors of culture-bound activities and values and correlate highly with occupational status.	Jensen is not arguing that that IQ is environmentally determined because it is culture bound. He is saying that IQ is culture bound in the sense that it is related to performance in a Western industrial society. The determination of the ability to perform a culturally defined task might itself be entirely genetic.
If the poorer performance by blacks on IQ tests has largely genetic rather than environmental causes, it follows that blacks are also genetically	Jensen has seen that this argument cuts both ways.

handicapped for other high status components of Western culture.	
Therefore, IQ testing is simply ONE manifestation of these genetically determined differences.	
In discussing the causes of the differences in IQ results between blacks and whites, two issues arise: 1) the stability of the IQ through an individual's lifetime; 2) the genetic basis of IQ.	
"The literature" indicates that IQ is more or less set by the age of 8.	To say that children do not change their IQ is not the same as saying that they cannot.
The genetic argument deals with the distribution and inheritance of intelligence. Jensen demonstrates that IQ scores are normally distributed.	There is nothing in genetic theory that requires, or even suggests, that a phenotypic character should be normally distributed.
The "underlying normality" of the distribution appears as a consequence of the genetic control of IQ.	We cannot speak of a trait being molded by heredity, as opposed to environment.
	Every character of an organism is the result of a unique interaction between the inherited genetic information and the sequence of environments through which the organism has passed during its development.
Heritability, its application to a specific population in a specific set of environments, and the difficulties in its accurate estimation are all discussed by Jensen – he does grasp the technical issues involved.	The heritability of a measurement is defined as the ratio of the variance due to the differences between the genotypes to the total variance in the populations. Different populations may have more or less genetic variation for the same character.
Concerning the causes of the difference between the IQ distribution of blacks and whites, Jensen concludes that genetic factors are strongly implicated.	The evidence that Jensen has offered is IRRELEVANT to the question. Jensen confuses the heritability of a character within a population with the heritability of the difference between two populations.
	The genetic basis of the difference between two populations bears no logical or empirical relation to the heritability between populations and cannot be inferred from it.

Jensen's second conclusion is that compensatory education for blacks has failed.	It is empirically wrong to argue that, if the richest environment experience we can conceive does not raise IQ substantially, that we have exhausted the environmental possibilities. The supposition that compensatory education must fail arises from a misapprehension about the fixity of genetic traits.
There is no reason to believe that the IQs of deprived children, given an environment of abundance, would rise to a higher level than the already privileged children's IQs.	On the reasonable assumption that ways of significantly altering mental capacities can be developed if it is important enough to do so, the real issue is what the goals of our society will be.

Jensen's (re)view of his own arguments
Based on the massive evidence presented by the Civil Rights Commission that compensatory programs have produced no significant improvement in measured intelligence or scholastic performance of disadvantaged children, merely to apply more of the same will not likely lead to the desired results.
It is necessary to look at individual differences rather than taking it as read that "all children are alike." This could be more fruitful than large scale programs based on a philosophy of general cultural enrichment.
His theory is that there are two broad categories of mental abilities: intelligence and associative leaning ability. Large racial and social differences are found for intelligence but negligible differences for associative learning abilities.
IQ ability is a selection of just one portion of the spectrum of human mental abilities, but is important to our society
The methods and evidence he reviewed in his paper led him to his conclusion that individual differences in intelligence are predominately attributable to genetic differences. He notes the lack of heritability studies in the minority populations and says they are needed to increase understanding of what our tests measure in those populations.
IQ differs, on average, among children from different social class backgrounds and the evidence indicates to him that some of this is attributable to environmental differences and some to genetic differences among social classes.
Social scientists decree on purely ideological grounds that all races are identical in the genetic factors that condition various traits, including intelligence.
But nearly every anatomical, physiological, and biochemical system investigated shows racial differences. Why should the brain be any exception? A genetic hypothesis is not unwarranted.

A problem that is more socially important than the question of racial differences per se, is the dysgenic trends that can be observed. That is, if the poorest blacks keep having the most children, then the genetic intelligence difference between whites and backs could widen even further.

Jensen on the points of Lewontin's analysis	**Lewontin's response to Jensen on his (Lewontin's) analysis**
Jensen's article is not an objective empirical scientific paper that stands or falls on the correctness of his calculation of heritability. It is a closely-reasoned ideological document springing from a professionalist bias and permeated with an elitist and competitive worldview.	
Lewontin's paper has an ad hominem flavor.	There was no ad hominem argument in Lewontin's analysis.
He agrees with Lewontin that the assumptions, theories and practices of educators, social and behavioral scientists are bankrupt.	
Re: Lewontin's remark "to say that children do not change their IQ is not the same as saying that they cannot" – Jensen has never said anything to the contrary.	
Re: Lewontin's argument that heritability of a trait within a population does not prove that genetic factors are involved in the mean difference between two different populations on the same trait – is one that Jensen never advocated. It is a straw man argument set up by Lewontin.	
Theoretically, Lewontin's statement that heritability within populations is irrelevant to the question of genetic differences between differences is true; however, it is necessary to distinguish between the possible and the probable. The real question is not whether a heritability estimate, by its mathematical logic, can prove the existence of a genetic difference between two group, but whether there is any probabilistic connection between the magnitude of the heritability an the magnitude of the group differences.	Jensen has responded to Lewontin's major scientific thrust at his thesis by saying that he (Lewontin) has demanded an unrealistic (mathematical) level of proof.

Lewontin makes no comment about the dysgenic trends discussed in his paper.	The evidence Jensen uses for dysgenic trends is indirect. Geneticists who used to make these arguments were proven wrong by Carl Bajema, who showed that this argument was based on an egregious statistical error: they forgot to count women who had no children.
In the final analysis, the main point for Lewontin remains: even if the difference between black and white were entirely genetic, what program for social action would flow from that fact?	
We are forced to examine all possible reasons for inequality. Society will benefit most if scientists and educators treat these problems in the spirit of scientific inquiry rather than as a battlefield upon which one of another preordained ideology may seemingly triumph.	Nonsense. What we are morally obliged to do is to eliminate blackness as a cause of unequal treatment – and for that program we have no need of genetics. The decision about what role each child is to play eventually in society and what rewards he will receive is social.

- At many places in the genes & intelligence debate assumptions have to be made which are not dictated by what natural reality is like. E.g. conceiving of intelligence as one thing vs. a diversity of types of intelligence; measuring intelligence on one scale vs. a diversity of scales vs. not measuring it at all.
- Many definitions of intelligence(s) exist; they differ along many dimensions: innate <-> trained; unchangeable <-> changeable; single <-> multiple; testable <-> not; can be used to enhance life possibilities <-> to restrict; predictive of socially valued outcomes <-> not; inside person <-> in relationships. If you choose one, e.g., what IQ tests measure, and study its heritability or its alterability, you then have to show whether and how this extends to other definitions of intelligence.

5. Connections and resources

American Psychological Association (2001). "New model of IQ development accounts for ways that even small environmental changes can have a big impact, while still crediting the influence of genes." www.apa.org/releases/iqmodel.html (Apr. 15).

- Introduces a model that allows for both the increase in average IQ test scores each generation (the Flynn effect) and the high heritability of IQ test scores.

Taylor, P. J. (2014) Nature-Nurture? No: Moving beyond the gaps in the sciences of variation and heredity" Arlington, MA: The Pumping Station—from page 41:

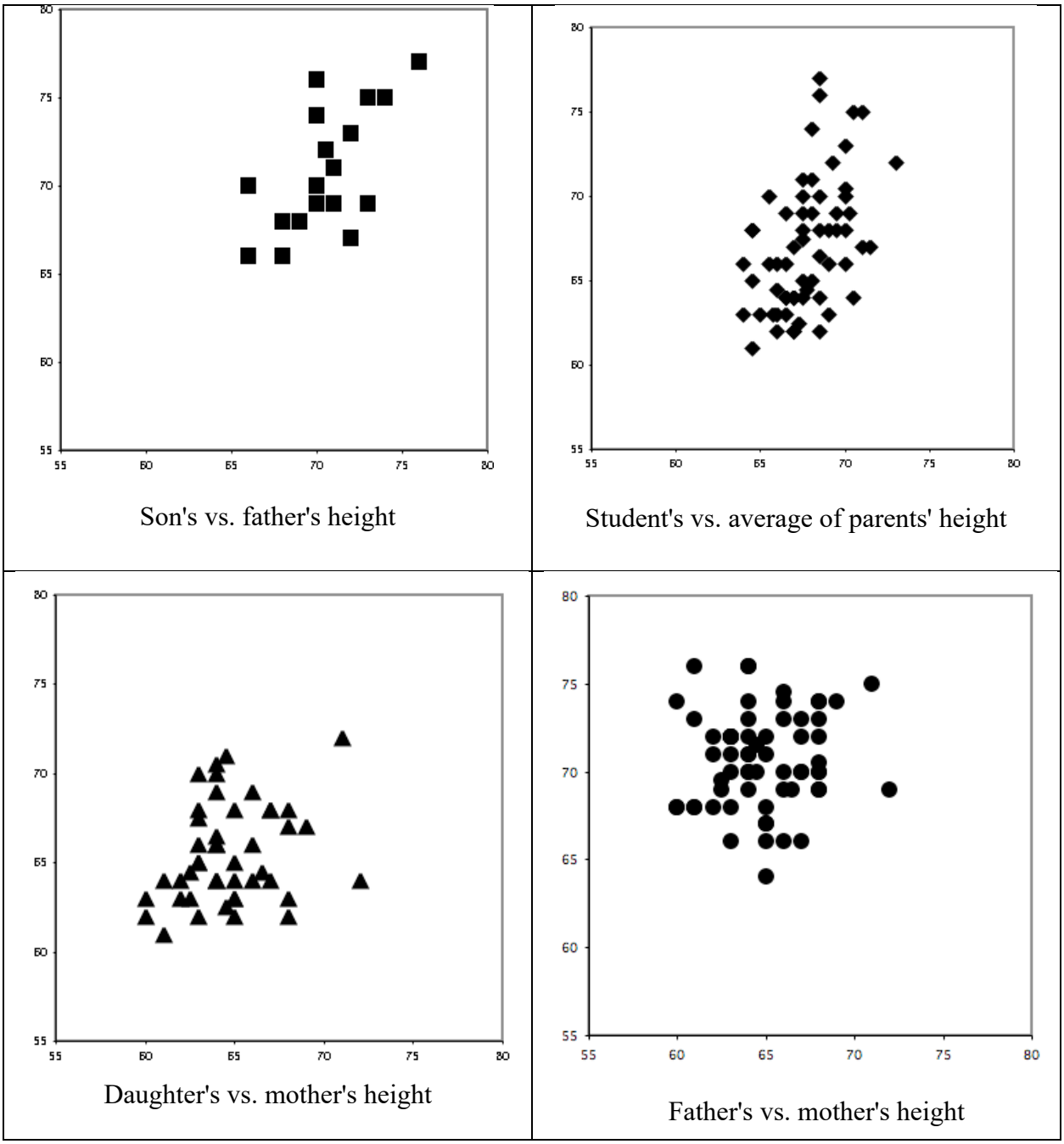
- [Lindman says] “the observed differences between schools” when referring to the observed differences between averages for schools. It is still commonplace to hear typological expressions of the kind “men are taller than women,” “men tend to be taller than women,” or “men are, on average, taller than women.” Some might dispute the label typological, saying that the implicit variation is understood. They might see little to be gained by wordier statements that make the variation explicit, such as, “the variation among men’s heights centers at a point that is greater than the center of the variation among women’s heights,” or “the variation among men’s heights and the variation among women’s heights overlap, but some of the men’s variation lies to the right of the women’s variation and some of the women’s lies to the left of the men’s.” However, can we be sure that it is simply linguistic convenience to use simple expressions that put group or class membership first and deviation as implicit or secondary? If not, the wordier, non-typological alternatives help keep in view the possibility that the factors underlying the pattern in the data could vary among men and women and need not include factors solely possessed by one sex or the other..."

Woodhead, M. (1988). "When psychology informs public policy." American Psychologist 43(6): 443-454.

- Where Jensen concluded that early childhood education had not boosted IQ test scores in the 1960s, subsequent research showed that in the longer term many other socially desirable measures, such as high school graduation, did improve.

5b. Add to this blog post to provide suggestions and resources for revising the chapter.
5c. Adaptation of themes from the chapter to students' own projects of engaging your audience in learning or critical thinking about biology in its social context: Suggestions for how to do that:

1. Identify writing where people speak about differences between groups as if everyone in each group can be treated as if they were at the group average. (See examples above from Taylor 2014.)
2. Brainstorm with instructor.



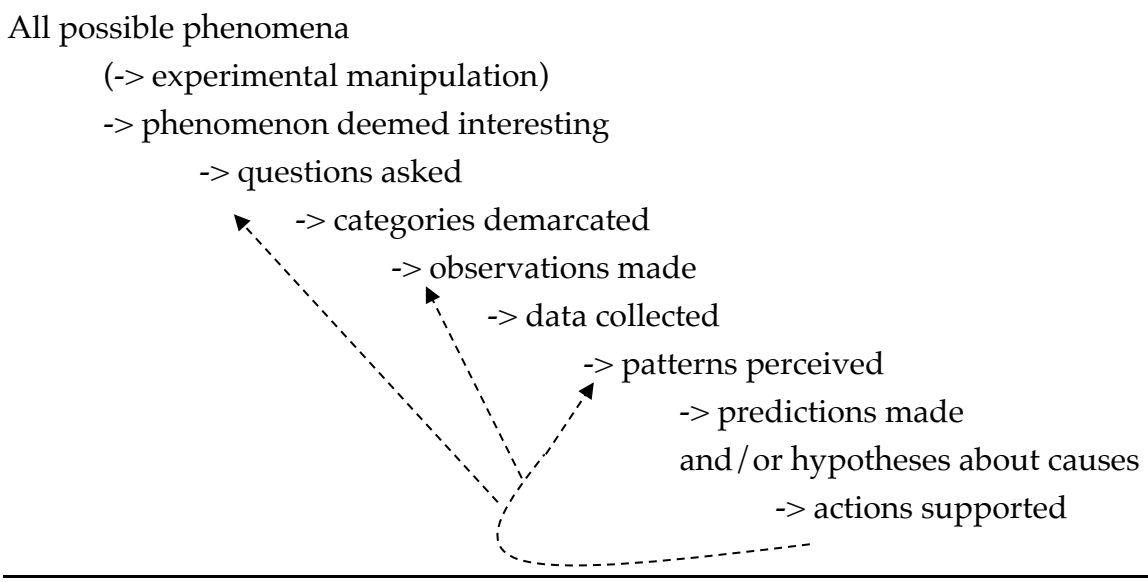
Son's vs. father's height

Student's vs. average of parents' height

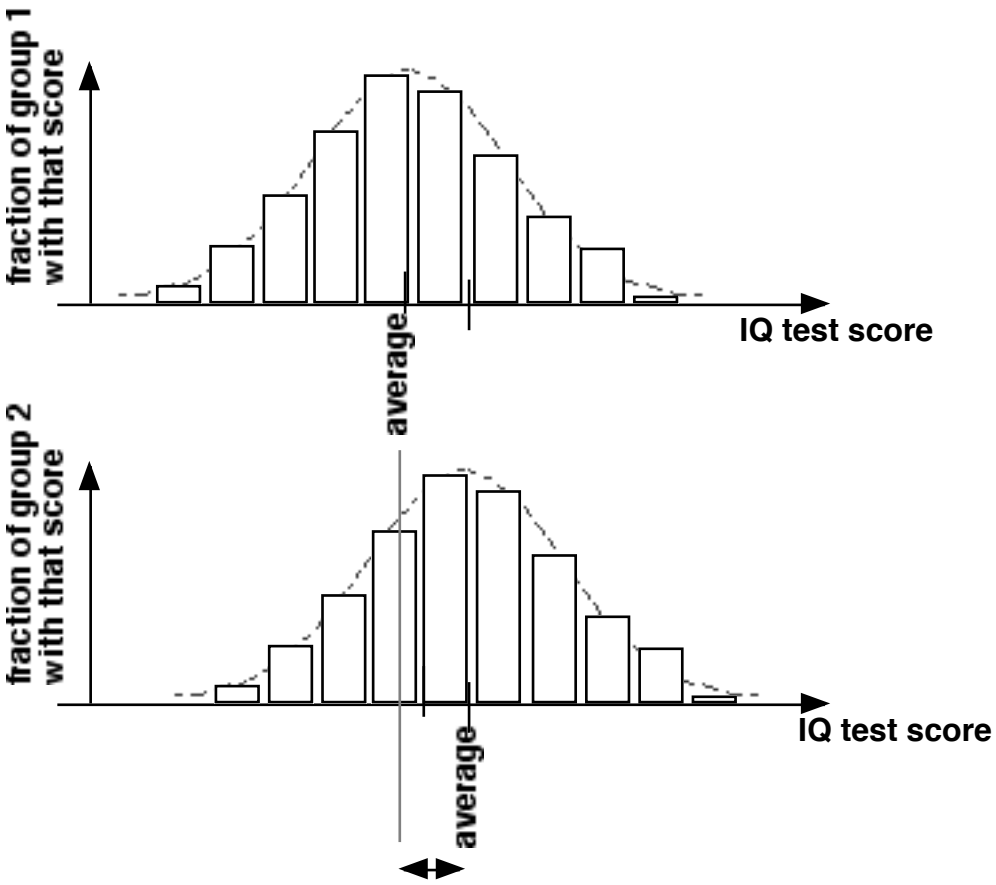
Daughter's vs. mother's height

Father's vs. mother's height

Plots of height measurements (in inches) for 63 college students and their parents.



A chain of steps in scientific inquiry in which each step involves assumptions and is open for negotiation and wider influences. The dashed lines depict the possibility that desired outcomes for the later stages influence decisions made at earlier steps.



What would you do on the basis of these patterns?

e.g., Group 1 community leader: Push for better schools? Get depressed because Group 2 will stay ahead...?

What more would you want to know about these patterns before you decided what to do?

e.g., IQ researcher: Work with geneticist to look for genes that group 2 have that group 1 doesn't...

Social negotiations around genetic screening

1. Introduction

The debate about the changeability of IQ test scores (Jensen vs. Lewontin) referred to the heritability of IQ test scores, but no actual genes. It also referred to the limitations and possibilities of education, but did not focus on specific educational projects—how they succeeded or failed and in what circumstances. In contrast, this session examines how specific groups (or "voices") in society shape or are involved in the application of knowledge about specific genes.

1b. Mini-lecture

- PKU--Substituting a genetic condition for chronic illness and second-generation effects
- Initial look at intersecting processes (which is the focus of next chapter)
  (Visual Aids)

2. Reading

- Preview the activity for the class (#3).
- While reading Rapp, "Moral pioneers" and Paul, "The history of newborn phenylketonuria screening", make notes to help you contribute to the activity.
- Secondary task: As you read Paul, use what she describes about the history to create a multi-stranded timeline (analogous to the ones in the mini-lecture), where time goes from pre-1960s to 1990s and the strands might include PKU people; diagnosis; care; social support and regulation; advocacy; research/science; and wider social context. Do not worry about getting this neat—it is simply an initial exercise in diagramming intersecting processes, which is the topic of the next session.

Paul, D. (1997). "Appendix 5. The history of newborn phenylketonuria screening in the U.S.," in N. A. Holtzman and M. S. Watson (Eds.), *Promoting Safe and Effective Genetic Testing in the United States*. Washington, DC: NIH-DOE Working Group on the Ethical, Legal, and Social Implications of Human Genome Research,137-159.

- Precis TBA

Rapp, R. "Moral Pioneers: Women, Men & Fetuses." *Women & Health* 13 (1/2, 1988): 101-116.

- Precis TBA

3. Activity

If the case of phenylketonuria (PKU) is any guide (Paul 1998), significant complexities should be expected to arise if neonatal genetic diagnosis and advice about risks and about possible protective

measures become widespread. Moreover, just as PKU individuals are subject to diverse influences on their pathways of development over the life course (Rapp 1988), there are diverse influences to which PKU individuals are subject on their pathways of development over their life course.

In this light, design a forum to help supplement advances in genetic screening by leading communities to develop

a) greater tolerance for normal variation;
b) social measures to care for people suffering from abnormal variation; *and/or*
c) multiple voices/constituencies/ethical positions around gene-based medicine.

Steps

a. Guided freewriting: "My experience of tolerance (or intolerance) of normal variation, of caring (or lack of caring), and of discussion about gene-based medicine makes we think about...."

b. Discussion in pairs about what forms a "forum" could take.

c. Web-searching to learn about existing models of forums of the kind you consider in #b. Consult with instructor at some time during the searching step or the next design step.

d. Design a forum, making clear:

i) What kind of forum;
ii) Which of goals it focuses on and what specific issues/questions;
iii) What the audience would be;
iv) How it might be organized (what people or groups to get involved, etc.);
v) How you would assess whether it helped and how to improve it; and
vi) How it draws on what you learned from the readings (Paul, Rapp, and any others you find).

e. Present to class, 5 minutes each, with each student giving Plus-Delta feedback: Feedback that begins with an appreciation (plus or +) before making a suggestion for change (delta or Δ).

4. Synthesis and extensions

- Rapp draws our attention to many constituencies and voices in the arena or reproductive interventions, in contrast to the dominance of white, male experts and a medical model: "Until we locate and listen to the discourses of women who encounter and interpret a new reproductive technology in their own lives, we cannot go beyond a medical model." Medical model = individual risks, benefits and choices (aided by dominant metaphors of human perfectibility and individuals holding within them their potential) vs. situated, social responses, e.g. social support for the disabled,

Down syndrome support groups.

- Genetic purification—Consider this strong proposition: "I have heard some argue that prenatal diagnosis and selective abortion would reduce society's burden in having to give special care for very disabled people and thus free funds for general health care, education, etc. for the mildly disabled. I have also heard the strong counter-proposition that such "genetic purification" in practice works against tolerance for the usual range of variation and measures to care for the abnormal. To understand the logic of this proposition consider an analogy: The health and fitness boom of the 1980s seems to have reduced tolerance for plump, "overweight" people. Those who have kept themselves trim tend to think that overweight people ought also to be able to do something about their figures. In the light of this analogy, Rapp's articles, your own experience, and research into the published literature, discuss the contention about "genetic purification."
    - Genetic purification thought-piece by student in 2006

5. Connections and resources

Taussig, K. S. et al. (2003) "Flexible Eugenics: Technologies of the Self in the Age of Genetics". Pp. 58-76 in Alan Goodman, Deborah Heath and Susan Lindee, eds. Genetic Nature/ Culture: Anthropology and Science Beyond the Two Culture Divide. Berkeley, CA: University of California Press, pdf

- Genes and Human Disease, World Health Organization

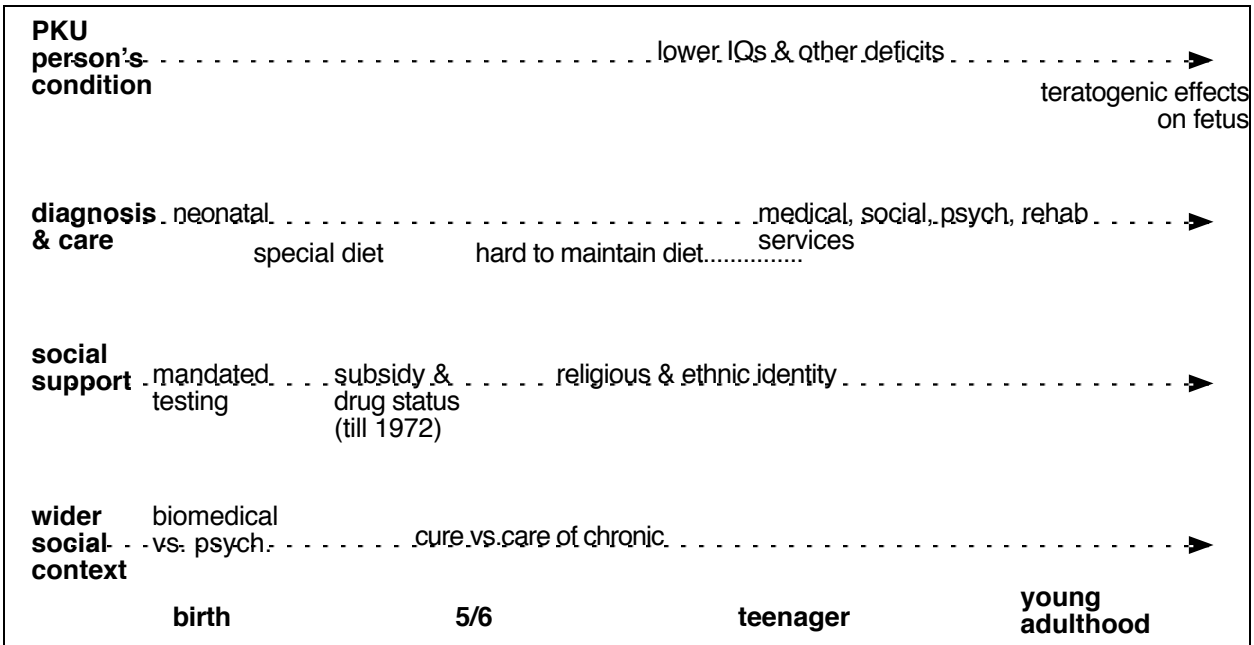
Yoxen, E. "Unnatural selection/Gene Therapy." In Unnatural Selection?, Pp. 157-173. London: Heinemann, 1986.

- Sequence of potential developments (Yoxen): prenatal screening & selective abortion -> somatic cell therapy -> germ cell (&early embryo) modification -> enhancement of specific genetic traits -> enhancement of more complex attributes.
- Although, in Yoxen's view, there is no absolute technological inevitability in this sequence, each step would make the next more feasible. Yoxen proposes that the public should discuss the implications and so individuals can make choices that enhance their freedom, self-esteem and sense of responsible reproductive behavior. (How else could limits be implemented that check commodification and technological development? What contradicts these social determinisms?)
- Public discussion of science does not necessarily mean direct involvement in technicalities, because public discussion that affects the possible directions of science does not stop with technical issues -- the gay liberation movement in the 70s made it possible for people to lobby hard for more AIDS research in the 80s while they probably would not have been listened to a decade earlier. Scientists who invoke fear of the public's direct involvement in technicalities may be suspected of having an

interest in limiting public involvement or influence in political decision-making concerning the direction of science.

5b. Online forum, through which students can provide suggestions and resources for revising the chapter
5c. Adaptation of themes from the chapter to students' own projects of learning about or engaging with biology in its social context: Suggestions for how to do that:

- Design a forum that brings out multiple voices in your audience so as to enhance the critical thinking everyone does about your topic concerning biology in its social context.



Intersecting processes over the life course of individuals with PKU

(*Single gene mutation -> early biochemical diagnosis -> lifelong management of chronic condition*

Including: ongoing struggle to secure health insurance coverage for diet ands to enlist family/peer support for staying on diet. Possibility of "maternal PKU")

Multiple voices speak to PGD and "genetic purification" Jan Coe (2006)

The contention that the utilization of services such as preimplantation genetic diagnosis (PGD) and selective abortion would reduce the burden on society for caring for very disabled people while freeing funds to support less-disabled persons is debatable. One might similarly ask whether the utilization of radical mastectomies by women has lead to more funding for breast cancer research. The two are not necessarily, or causally, related. The more compelling implicit question is whether utilizing PGD may amount to practicing “genetic purification.”

To examine this claim thoroughly, one must declare at the outset: it depends upon who you ask. As with most complex, multidimensional problems, the answer is likely to be different according to who is given voice.

This discussion will enlist the voices from three groups: 1) people with disabilities (although it is acknowledged at the outset that there is no such homogenous entity as “the disabled community”), 2) bioethicists, 3) social scientists and health/medical personnel. Addressing facets of the claim may yield an incremental construction for an answer more rich and nuanced by being constituted from different stakeholders.

The Council on Responsible Genetics, a non-profit organization that fosters public debate about the social, ethical and environmental implications of genetic technologies, sees the lack of a “bright line” between selection against disability, condition, or trait as a problem. “Routinizing the practice of testing can open the door to termination of individuals for a great many characteristics, including non-medical ones like sex selection” (2001, CRG). The Council believes, as the scenario suggests, that such routinizing will lessen people’s acceptance of unusual characteristics and lead to devaluing the people who exhibit them. They point out that the attempt to eliminate disabilities through PGD and/or selective abortion is misguided in any case because a majority of disabilities are acquired through accidents and other environmental causes. Rather than forcing women and families to become “quality control agents,” the CRG feels that they should be assisted by economic and social supports to enable them to raise disabled children without going broke.

An argument often made by disability activists is that the so-called medical model characterizes disability as a source of suffering, a deviation from the “norm,” an illness or a condition that needs to be treated or cured. Yet there is much evidence that disabled people themselves do not feel this way. In a table that compares self-esteem ratings by non-disabled people, non-disabled people imagining themselves with a severe spinal cord injury, and members of a spinal cord injury survivors group, Gregor Wolbring shows that people with actual spinal cord injury have significantly higher feelings of self esteem that do people who only imagine how they would feel if they had that injury. Strikingly, 95% of the survivor group agreed with the statement “I feel that I am a person of worth,” while only 55% of those imagining themselves with spinal cord injury (SCI) did. 83% of those imagining themselves with SCI agreed with the statement “At times I feel no good at all,” but only 39% of people with actual spinal cord injury did. And these are not isolated findings (Wolbring, 2002, p.28)

In contrast to a medical model, disability activists advocate a social model of disability which sees the actual condition, be it Down syndrome, cystic fibrosis, achondroplasia or deafness, as an impairment; the “disability” relates to the array of barriers, attitudes and lack of opportunities that a disabled person faces in society. This model does not deny that the biological realities faced by disabled people are insignificant, but it views them more on a continuum of difference rather than abnormalities. For example, the Canadian Down Syndrome Society “redefined” the definition of DS in 2003. They state that:

Down syndrome is a naturally occurring chromosomal arrangement that has always been a part of the human condition… Down syndrome is not a disease, disorder, defect or medical condition. It is

inappropriate and offensive to refer to people with Down syndrome as "afflicted with" or "suffering from" it. Down syndrome itself does not require either treatment or prevention… The sole characteristic shared by all persons with Down syndrome is the presence of extra genetic material associated with the 21st chromosome. The effects of that extra genetic material vary greatly from individual to individual. Persons with Down syndrome karyotypes may be predisposed to certain illnesses and medical conditions, but that genetic arrangement does not guarantee their development. The same illnesses and conditions are also present in the general population. Timely and accurate diagnosis and appropriate treatment of these illnesses and conditions improves both the length and quality of life, to the same extent as would be expected in the population without Down syndrome… (CDSS, 2003).

When viewed through the social perspective of disability activists, it is clear that what drives the move to prevent children being born with a disability is the discrimination experienced by disabled people (Shakespeare, 2005). Fear of how they would cope with the demands of a disabled infant and cognizant of the negative stereotypes that attend to seeing disabled people in public, it is understandable that many parents would choose to avoid having a disabled child. And yet, as Shakespeare notes, “while the question of disability is individualized and privatized, the broader question, about how society supports disabled children and their families, is neglected” (Shakespeare, 2005, p. 47).

Whether multiple “individual” decisions by parents utilizing PGD to choose non-affected embryos will ultimately give rise to eugenics in the societal or population-based sense is contested. Part of what muddies the situation is the issue of autonomy – the idea that individual women (and parents) should be able to choose to terminate a pregnancy based on their own personal values and beliefs. Some disability activists would say that such autonomy is illusory because genetic counseling by medical personnel is one-sided and based primarily on medical perspectives. Parents are thus predisposed to negatively view the choice to have a disabled child. Pilnick (2002 cited in Pritchard, 2005) states that prenatal screening is undertaken with the principle of informed refusal, rather than informed consent. Pilnick argues that women are obliged to become increasingly dependent on the medical profession through the medicalization of pregnancy. And although genetic counselors strive to be nondirective, the mere fact that such counseling exists in a medical context is part of the message. Later on, we will see that Rapp (1998) and Wertz (2000) show the medical establishment is not unchallenged by parents, however. Many interpretations and internalizations confound a single framework in which to understand the meaning of disability.

For another perspective on the issue of PGD and genetic purification, we turn now to the views of bioethicists. The same caveat applies here – there is no one view or model that prevails. Along a continuum of the acceptability of PGD, there are several positions to be found. Savulescu (2001) provides a rationale for accepting what he terms the “eugenic” selection of embryos afforded by PGD by employing his principle of “Procreative Beneficence.” This principle makes genetic testing a moral obligation, for parents should select the child of the possible children they could have, who is expected to have the best life, or at least as good a life as the others, based on the relevant, available information (Savulescu, 2001, p. 415). This view seems to place an inordinate confidence in presumably scientifically-derived “relevant” genetic information. All things being equal, he says, why not select the embryo with no predisposition to asthma, for example. This is extraordinary because, even *if* a gene for asthma (or any other trait or condition) is found in the DNA of the embryo, its mere presence is not sufficient to cause the disease to develop in the child. Savulescu then effects a fine tuning of his argument by stating that it is not asthma, per se, which is important, but its impact on a life in ways that matter which is important (p. 419). The best life, according to Savulescu, is the life with the most well-being. Through a circuitous route by reference to various theories of well-being, it seems that Savulescu understands the best life to be that defined by a person who is capable of understanding that they enjoy the best life possible.

Moving to a defense of his views against the "Disability Discrimination Claim," Savulescu uses a hypothetical rubella epidemic to argue that doctors should encourage women to use embryos which they produced prior to the epidemic in preference to ones produced during the epidemic. The reason is that "it is bad that blind and deaf children are born when sighted and hearing children could have been born in their place" (2001,p. 423). Bad for whom, or to whom, one wonders. No doubt to temper the baldness of this statement, Savulescu adds in the following sentence that to say this does not necessarily imply that the lives of those with disability are less deserving of respect and are less valuable. "It is important to distinguish between disability and persons with disability." He offers the comment that no doubt gave rise to this scenario: "there are better ways to make statements about the equality of people with disability (e.g. we could direct savings from selection against embryos/fetuses with genetic abnormalities to improving well-being of existing people with disabilities)" (2001, p. 423). As noted at the beginning of this discussion, the notion that 'savings' would accrue from PGD techniques is highly questionable, and that these hypothetical savings could be directed to improving the well being of disabled people flies in the face of current reality.

A vastly different perspective on disability is offered by Tom Koch. The medical model of disability is an outcome, he says, of "an ideology defining the limited variations permitted in the construction of difference in contemporary society" (Koch, 2005). As with elements of the Savulescuian notion of well-being, the medical model posits "an individual as a discrete, self-reliant, self-conscious person with a store of goods at least equal to others' in society. To be disabled is thus to have a lesser endowment, to be unable to experience the world in a way similar to that of other, similarly discrete individuals" (Koch, 2005, p. 124). In opposition to the 'ideology of normalcy,' Koch favors the ideology of difference, in which "all discrete individuals are by definition assumed to be incomplete and un-able, gaining full personhood only interpersonally and socially" (2005, p. 124). Similar to the studies mentioned by Wolbring in the previous section, Koch finds that the claims by disabled people that their lives were full and equal "were assumed to be not rational but *rationalizations* because their insistence violated assumptions of bioethical and clinical life quality based on a standard of mundane normalcy" (2005, p. 127, italics in original). While his position on the termination of embryos through PGD is unknown, it can be inferred to be the same as his position on abortion, euthanasia, and suicide: that they are based on 'negative deviations from the mundane norm' and thus cannot be supported.

Peter Singer is a bioethicist who riles a good many people, not the least of whom are disability activitists. In a response to Koch's article, he takes the opportunity to set the record straight regarding what have been regarded as his controversial views on disability, and in particular, disabled fetuses or infants. Singer makes a distinction between a person living with a disability, which he would support fully in terms of integrating into the community and in living and working as 'normally' as they possibly could, and a fetus that has a gross disability (such as anencephaly) because the fetus would have no chance of becoming a unique, rational, self-aware being (Singer, 2005). On the other hand, he does not believe that newborn infants have the capacities that distinguish a fully grown, rational, self-aware human being nor does he believe that the *potential* of a being is enough to make it wrong to kill that being (2005, p. 131). This seems to allow a lot of leeway for disposing of fetuses and newborns, however. If the criteria of being and personhood do not inhere until adulthood (or near adulthood), surely Singer would not condone the killing of children or teenagers! Singer skirts this implication by stating that "the fact that a being is capable of understanding that it has "a life," and of having hopes and plans for how that life will go, does make it worse, other things being equal, to end that life" (2005, p. 131).

A call for an agenda for bioethics on disability was made by Kuczewski in 2001. Without going into all five convictions to guide bioethicists that Kuczewski enumerated, it is helpful to consider some of the peer commentaries that accompanied his article. In particular, Alan Regenberg dissects the quote that headed the Kuczewski article:

If I were listing the most dangerous people in the U.S. today, bioethicists, aka medical ethicists, would top my list – way above skinheads, whose beliefs they appear to share. -- (1994, Alice Mailhot, notdeadyet.org)

Regenberg makes the point that academic bioethicists are often guilty of writing for their academic audiences in ways that are likely to mislead and enflame parties not familiar with that style of discourse. In particular, Singer's "sin" was failing to adapt his claims to an "appropriate format capable of responding to the vociferous critiques of his detractors" (Regenberg, 2001). Regenberg does not consider the merits of the various claims, but rather highlights the need for bioethicists to access the skills needed to bridge gaps between concerned parties in these ethical debates, something that Wolbring, in his commentary reiterates once again. As he pithily notes, "we would not accept a debate about women's health without women being present, and in the same spirit we should not accept a debate about bioethical issues without disabled people present (Wolbring, 2001, p.2). For his part, Singer's commentary on Kuczewski's article raises a valid, but uncomfortable point. He asks rhetorically, who decides [about quality of life] for those with profound intellectual disabilities? There has been a tendency, Singer continues, for people with physical disabilities, but normal intellectual abilities, to regard themselves as spokespeople for those whose intellectual disabilities preclude them from representing themselves. "It isn't clear to me why the fact that an articulate, intelligent person is in a wheelchair makes that person a better representative of someone who has profound intellectual disabilities than someone equally articulate and intelligent who is able to walk unaided" (Singer, 2001, p. 56).

Here it seems we come to the crux of why the issue of disability (not to mention disability and PGD and genetic purification) is so troublesome: writers do not generally pre-define their conceptions of disability – which can obviously range from minor physical features like cleft palates or mongoloid features to severe mental retardation with few outward "abnormal" characteristics. Infants with gross deformities such as anencephaly are lumped in with spinal cord injuries, cerebral palsy or cystic fibrosis. Most of the medical vs. social debate is referring to disabilities that allow at least some percentage of assisted functioning. Unless it is clear that one is speaking, as Singer often does, of profound disabilities, people can continue to speak at cross purposes. Additionally, outside of the bioethicists' and disability advocates' camps, the main concern for parents may be not 'normality' but the appearance of normality that counts. To consider why this may be so, we can turn to a rich literature generated by social scientists such as anthropologists, child psychologists and psychiatrists, genetic counselors, clinical geneticists, and health economists, which form the next section or perspective on the claim.

In order to address the views from social scientists, I have subdivided them into two categories: those writers that report on actual studies with disabled people or parents/prospective parents of disabled children, and writers who thoughtfully speculate on the outcomes, implications, and fears that genetic advances and reproductive techniques will mean for future generations.

Starting with the work on amniocentesis by Rayna Rapp, it is apparent that the "lived experiences of reproduction" need to be consulted as there is no universal explanation of why some women are able to integrate a disabled child into their families and some try to prevent it. Rapp makes a strong case for the insights that families with disabled children can contribute to scholarship. Here, she says, "religion, ethnicity, class and family history powerfully shape responses to having a child with a genetically stigmatized condition. Reflections on the meaning of maternity and paternity and the value of children are embedded in the stories parents of the disabled tell as they transform medical diagnosis into the social fabric of daily life" (Rapp, 1988). Her 1998 article on refusing prenatal diagnosis is filled with grounding details arising from narratives that capture the variety and logics that women and families use to make sense of positive diagnoses of disability.

Class differences (finely calibrated, however), ethnicity, previous reproductive history, gender relations, familiarity with the statistical delivery of risk information given by genetic counselors – all play a part in how a woman internalizes and acts (or does not act) on the prospect of bearing a disabled child. Paradoxically, for a condition such as Down syndrome, about which there is both ample information and advocacy/support groups, there is also a very high – 90 to 95% - abortion rate. Rapp tells the story of a certain young woman (whose family included a sister with spina bifida) that became pregnant and went for prenatal tests. Relieved that her fetus did not have spina bifida, the young woman was philosophical about the prospects for her child – which *was* diagnosed with Klinefelter's syndrome. Growth problems, sterility, and possible learning disabilities or mild mental retardation are features of Klinefelter's, but these problems were less salient when the young woman was told that her son would "look normal." As Rapp puts it, it was the relative invisibility of the consequences of her son's atypical chromosomes that made them normal in her estimation (Rapp, 1998, p.64).

There is something in this story that resonates with Koch's ideology of normalcy in terms of the exception proving the rule. Were there not unambiguous pressure to adhere to the accepted norm, especially in physical presentation of symptoms, people might be more forgiving of deviations from that norm, especially since greater anomalies may hide within a "normal" body.

Götz and Götz (2006) provide additional complexity to the question about how parents react to prenatal diagnosis and PGD. Their study of parents of children with cystic fibrosis who were initially determined to use prenatal testing but eventually refused it allowed them to posit a model of change that contextualizes and refutes the proponents of more static models of disabilities. Among the explanations given for their change of heart, parents mentioned seeing their first child grow and develop favorably in many ways, gaining experience with the disease, and feeling more confident with the management of its complex treatment (2006, p. 295). It is also instructive to follow the stages in their model of change. Beginning at stage 1 with information and counseling, through stage 2 to what can be a lengthy period of absorbing information and developing new concepts, the crunch comes at stage 3, when a pregnancy means that action is required. Götz and Götz found that many parents – faced with the choice to "play God" ultimately refuse to do so, preferring to delegate decision-making to fate, or, in some cases, God (2006, p. 297). These results call into question the assumption that because parents are now able to select against disability, they will in all cases.

A study showing a preference for PGD among those patients who have undergone previous terminations lends some support to the claim that PGD could be a valuable alternative to prenatal diagnosis -- as well as confirming that the procedure is highly stressful. Lavery and others (2002) received 36 completed questionnaires from 67 they sent to patients who had actually undergone PGD. They found that the main advantage articulated by patients was being able to avoid the "therapeutic" termination of pregnancy (2002, p. 2466). Disadvantages included the low 'take-home baby' rate of 15-20% per cycle started, and cost.

Priscilla Alderson reports from her exploratory qualitative research with 40 adults with congenital conditions, including 5 with Down syndrome, that some people with Down syndrome live creative, rewarding and fairly independent lives, and are not inevitably noncontributing dependents (Alderson, 2001, p. 627). While conceding that her study may have involved exceptionally able people, Alderson is correct that:

…the potential of people with learning difficulties will not be realised until they have many more opportunities to develop it. Research which enquires beyond morbidity into people's potential and achievements, and the social influences which support or constrain them, is required before their ability can be assessed realistically. Such research moves on from notions of fixed (dis)ability, static syndromes, expert researchers and inadequate subjects, to acknowledge how the research

questions, methods, interactions during interviews, and hidden assumptions about medical or social models of disability, all shape the data (2001, p. 636).

There is a case to be made for more research that examines the social context of the lives of disabled people, much as Shakespeare has done with the AnSWeR web site (Antenatal Screening Web Resource). Alderson raises a troubling point by questioning whether Down syndrome began to be screened because this was technically possible rather than because it was the most serious condition. Before the numbers of Down syndrome people fall through prenatal testing and PGD, she stresses that it is important that more research be conducted to enable broader, more realistic evidence about the range of ability among people with Down syndrome, and about links between intellectual ability, contentment and self-esteem, noting that the general population shows no clear correlations and that life style may be more salient than intelligence to quality of life (2001, p. 636). [This is a point that high profile persons such as James Watson may profit from considering, given his views.]

In a broad-ranging international study, Wertz (1997) surveyed the ethical views of genetics professionals from 37 nations based on their responses to information presented in the form of case vignettes. The surveys took place in 1985-86 and again in 1994-95 and provide a wealth of information, statistics, and cross-cultural comparisons.

The differences are revealing between geneticists, genetic counselors, and patients in terms of which fetal conditions for which they would choose to abort. Of the 24 conditions, a majority of the geneticists, both inside and outside the United States, would themselves abort for 15. In the United States, 85% would abort for Down syndrome, 92% for severe, open spina bifida, 74% for cystic fibrosis, 72% for Huntington disease, and 56% for achondroplasia. A majority of the U.S. genetic counselors would abort for 11 of the 24 conditions, while among patients (91% women) only a small majority would abort for four of the 24 conditions. As Wertz notes in something of an understatement, “the results suggest that there is room for considerable further research on how the different worldviews [among geneticists, genetic counselors, and patients] are mutually understood in the process of counseling, if indeed they are understood” (Wertz, 1997, XI.,¶8).

Pertinent to the topic of PGD and genetic purification, it is worthwhile to go back and consider the encounter with the medical personnel (M.D. geneticist or Master’s level genetic counselor) from whom parents first receive the news about a positive diagnosis. On questions relating to nondirectiveness (what Wertz called the “motherhood and apple pie” statement of U.S. genetic counseling) there was no evidence that this is what people really want (1997, IX., ¶4). While parents would resent being told what to do in this context, they also appeared to want more than a ‘value-neutral’ information machine. Moreover, Wertz says, they want to think that they are facing a human being who has a set of values and who cares about them and about their own values and concerns.

This dovetails with Rapp’s findings that structural reasons for accepting or refusing prenatal testing can even be influenced by the characteristics and staffing of prenatal clinics. Writing about the variation between clinics on the acceptance rates of genetic testing, she notes that in one clinic with a 70-80% acceptance rate, the clinic provided a stable and welcoming environment in which the women tended to feel comfortable and to trust the nurses. At another clinic that had been a ‘site of struggle over services’ for many years, the acceptance rate was 30–40%. At this clinic the waiting times were long, there was poor professional-patient communication, and it was “much more likely that a woman [would] break a counseling appointment or sit through it in a state of distrust….Acceptance rates are conditioned by the microsociology of access to respectful medical services” (Rapp, 1998, p. 53).

It is worth remembering that before we make assumptions about genetic purification, we need to

think about how and in what manner people receive information about genetic testing; and before we make assumptions about their willingness to use a reproductive technology like PGD, we need to think about what circumstances brought them to the clinic or a referral to a geneticist; and before we make assumptions that the information provided by the genetic counselor was ultimately the point at which a decision was made, we need to think about "…economics, women's roles, services for children with disabilities, cultural expectations, availability of contraception, [and] abortion." The point is that there is necessarily not a linear route from diagnosis to test, and from test to more tests and from more tests to genetic purification – the multidimensionality of the issue means that at any point along the way people may choose differently and confound expectations.

The final facets to confront include medical and non-medical factors that may have an impact upon people's willingness and/or capacity to utilize certain reproductive technologies like PGD. These facets include policy issues, the availability of insurance, and the commercialization of testing.

A glimpse at some of the applications to which PGD may be put in the future is outlined by Robertson (2003). His purpose is to look ahead, assuming that current uses of PGD are "ethically and legally acceptable when performed according to applicable regulatory guidelines" (Robertson, 2003, p. 466). Leaving aside the question of the existence and adequacy of 'applicable guidelines,' one of the expanded uses of PGD could include routinizing services for the older patient group (>39 years) such that aneuploidy (abnormal number of chromosomes) analysis becomes the standard of care. Another growth area is likely in PGD for so-called *susceptibility conditions*. Screening for BRCA1 and 2 [breast cancer] susceptibility is mentioned in the context of avoiding the birth of children that face a higher than average risk of having cancer or some other serious disease. Robertson states that PGD may now make it possible to establish pregnancies free of the feared susceptibility condition (2003, p. 467).

In addition, there is now a precedent for using PGD for early-onset Alzheimer's disease, although it remains ethically ambiguous whether a parent who is dominant for the disease should be helped to select a disease-free embryo that they will possibly not live long enough to rear. Other uses that make headlines every now and then are the so-called "savior siblings" and PGD for sex selection or "family balancing." On the subject of using PGD for expressly non-medical traits, Robertson reasons that "it is too soon to reach definitive judgments about whether these uses, if ever feasible, would or should be permitted…Until they are closer to practical reality, they should not be an important factor in determining the acceptability of more feasible uses" (2003, p. 470).

Unlike the U.K., which has the Human Fertilisation and Embryology Authority (HFEA) to regulate and oversee existing and proposed uses of reproductive technologies, Robertson acknowledges that the situation is quite different in the United States where no agency exists that plays a role comparable with that of the HFEA. Despite this, he states that with PGD, the need for a new agency or more explicit public controls may be less pressing than initially thought. Why? Because "most of the new uses of PGD fit easily into old categories of efforts to ensure that offspring are healthy" (p. 470). At the very least this seems to side-step or gloss over whether, in fact, selection in all cases can be said to amount to ensuring the health of offspring.

The nexus of predictive medicine with insurance is another highly fraught arena, especially in the United States. Van Hoyweghen and others make a compelling case for the shift in focus from "…symptoms and treatment to pre-symptomatic diagnosis and preventative intervention" in the insurance industry (Van Hoyweghen, 2006, p. 2). In their discussion on lifestyle risk factors, they conclude that people with some lifestyle risk factors are seen by insurers as already ill and what is more: as people responsible for causing their own illness and therefore deserving of an extra premium (2006, p.4). On the face of it, this could work disadvantageously if applied to genetic

conditions. Parents could feel pressured to ensure that they only produced those children that were at least as healthy as possible at the start of their lives. Surprisingly, Van Hoyweghen reports that – at least in Belgium (where the study was undertaken) – a different scenario obtains. Restricted by law from using family history as a decisive risk factor, people who are at risk for genetic conditions may instead be considered *victims*; their "bad genes" are outside their choice or control (2006, p. 8). In this way, they see in Belgium the institutionalization of 'genetic essentialism'.

In the United States, Kaufert found that violation of privacy and the potential for genetic discrimination loomed large. Among clinicians she found that the underlying and general concern [was] how to counsel testing if the costs must be met out of third party insurance and result in a patient losing both a job and insurance coverage. "It is not the fear of living with the cause of death specified, but very pragmatic considerations of access to health care for oneself and one's family, and having a job" that mattered (Kaufert, 2000, p. 826). Although clearly of concern to citizens, legislation in this regard has stagnated:

For over ten years, Congress has considered legislation to ensure comprehensive protection for all Americans. The U.S. Senate passed the Genetic Information Nondiscrimination Act of 2003 (S.1053) [thomas.loc.gov] in 2003 by a vote of 95-0, but an identical bill was never introduced or passed in the House and the bill did not become law. A similar Senate bill, the "Genetic Information Non-Discrimination Act of 2005" (S.306), passed 98-0 in February 2005. Representatives Judy Biggert (R-IL), Louise Slaughter (D-NY), Bob Ney (R-OH), and Anna Eshoo (D-CA) introduced an identical bill H.R. 1227, in the House, on March 10, 2005. Currently the bill is being considered by three House committees - the Committee on Education and the Workforce, the Committee on Energy and Commerce, and the Committee on Ways and Means. (NHGRI, 2006).

If the pace of government action in legislating against genetic discrimination has been glacial, the same cannot be said for the genetic testing industry. Relative to earlier practice, Kaufert finds, "…commercialization has…dramatically changed the context of testing, stripping it out of the clinic and removing the intermediary roles of geneticists and genetic counselor" (2000, p. 823). Direct-to-consumer tests over the Internet have proliferated. This phenomenon so concerned the Secretary's Advisory Committee on Genetics, Health, and Society (SACGHS) that they wrote in 2004 to the Secretary of Health and Human Services, Michael O. Leavitt, expressing "…a strong concern that the promotion of such tests to consumers could be harmful if a health professional is not involved in the process" (SACGHS, 2006). The outcome two years later is that two inter-agency work groups have been formed to monitor claims made by companies advertising genetic tests on the Internet and to evaluate the public health impact of DTC marketing of genetic tests.

Some of the impacts upon people's willingness and/or capacity to utilize certain reproductive technologies like PGD may be quite tenuous, such as whether the rise in numbers of genetic tests will substantially lead - if not to "designer babies" - then at least to a desire for "normal" i.e. non-disabled babies in all cases. There is more at stake than a slippery slope argument in these debates. Whether the use of PGD will reduce society's burden in having to care for very disabled people may also turn on what conception of society we favor living in.

From this review of perspectives from disabled people, bioethicists, and social scientists and others, it is clear that - at the very least - the path from using a reproductive technology like PGD does not inexorably lead to genetic purification. The pressure to bear children who do not have a disability might be balanced by research into the lives of disabled people that will give needed information to those who doubt their ability to care for a child with special needs. Bioethicists may take up Kuczewski's suggestion that bioethicists imitate the legal profession and devote 5-10% to pro bono work in areas related to disability: independent living, long-term care, rehabilitation care,

and care of the indigent (Kuczewski, 2001, p.38). Certainly they should seek out and nurture an ability to translate debates so that more views may be considered and claims may be accurately appreciated and critiqued, as Regenberg suggests (2001). Genetic discrimination as an issue of importance to all may be addressed in the *next* administration. All of these things are possible.

The most important wedge against genetic purification may also be the sheer numbers and variety of individuals and couples who have a stake in allowing whether a deterministic future will go forward. Each individual decision is important and each individual decision cannot be predicted just by reference to the available technologies. Richard Ashcroft says, "…while we might regard individual choices and societal change as disconnected, or our evidence so poorly predictive of the connection between the two as ("from a policy point of view") better ignored, this seems to me a moot point. What sort of society would it be like if we all chose in such ways? Or wanted to (even if we were unable to do so in practice, or only few of us were)? One cannot simply dismiss this question as not susceptible to a scientific answer. It is surely just the sort of question philosophers and society at large are responsible for answering. **For in the answer lies the material for bringing the answer into effect**. (Ashcroft, 2003, 219, my emphasis).

If the answer tilts toward variation and tolerance, we will find that we have the means to make that a reality.

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Intersecting processes involving genes and environment

1. Introduction

This session extends perspectives from the previous two sessions—the debate about the changeability of IQ test scores and the possible involvement of multiple voices in the application of knowledge about specific genes—by tracing "intersecting processes"—the sequence of multiple causes building on each other over the individual's life history. This account of causality permits a number of conclusions about nature-nurture debates:

- Neither the unchangeability of genes nor the reliability of some gene- or biochemistry-based intervention would prove that the genes are the most significant cause of the behavior or disease that has been occurring in the absence of such treatment.
- Critics of genetic explanations could dismiss the attribution of an individual's behavior to genes (or 50% or 80% to genes) as a technically meaningless partitioning of variation without placing themselves at the other pole from genetic determination. That is, they would not have to make the counterclaim that the environment determines behavior or that, if the right environment were found, any desired behavior could be elicited. An intersecting processes account addresses malleability or immalleability of behavioral outcomes without ruling out genetic contributions.
- Similarly, critics would not need to rest their case on demonstrations that behavioral genetics has been or still is methodologically flawed, on textual deconstructions of the categories and rhetoric employed, or on attributions of political bias to the supporters of behavioral geneticists. These are all interesting, but, in light of an intersecting processes account of the behavior, not necessary for a conceptual critique of genetic determinism.
- There are multiple points of intervention or engagement that could modify the course of development.

1b. Mini-lecture

Intersecting processes in the social origins of mental illness

(Visual Aids)

2. Reading

The readings complicate the popular idea that human traits can be determined, say 60%, by genes and the opposing idea that the environment shapes most socially significant traits. Make notes on the models of complexities sketched in the readings.

American Psychological Association (2001). "New model of IQ development accounts for ways that even small environmental changes can have a big impact, while still crediting the influence of genes." http://www.apa.org/releases/iqmodel.html (Apr. 15).

Paul, D. (1997). "Appendix 5. The history of newborn phenylketonuria screening in the U.S.," in N. A. Holtzman and M. S. Watson (Eds.), Promoting Safe and Effective Genetic Testing in the United States. Washington, DC: NIH-DOE Working Group on the Ethical, Legal, and Social Implications of Human Genome Research, 137-159.

Taylor, P. J. (2004). "What can we do? -- Moving debates over genetic determinism in new directions." Science as Culture 13(3): 331-355.

The class activity will go beyond complicating ideas about direct determination of traits to using an "intersecting processes" framework to map out bio-social processes of development of traits. We will start with the history as told by Paul—complete or neaten up the secondary task from the Reading for last session.

3. Activity

Diagramming of Intersecting Processes

(a teaching activity under development)
Peter Taylor, Draft 8 Feb 2004; revised 17 April 2005; revised 6 Nov 2012

Acknowledgement: This unit draws inspiration and some ideas from Matthew Puma's adaptation of my teaching about intersecting processes in CrCrTh 640 http://www.faculty.umb.edu/peter_taylor/640-02.html) during Spring 2002.

Goals for students

1. to understand the development of biomedical and social phenomena in terms of linkages among processes of different kinds and scales that build up over time—genetics, treatment, family and immediate social context, social welfare systems and economics, wider cultural shifts, ….

2. to use graphic organizers to help them visualize such "intersecting processes" and to identify places where detail is missing and where further inquiry is needed.

3. [depending on level of students and prior preparation] to contrast the implications of thinking in terms of direct causation (like spokes going to a hub) with "heterogeneous construction," my term for the following ideas:
"a) Without any superintending constructor or outcome-directed agent,
b) many heterogeneous components are linked together, which implies that
c) the outcome has multiple contributing causes, and thus
d) there are multiple points of intervention or engagement that could modify the course of development. In

short,
e) causality and agency are distributed, not localized. Moreover,
f) construction is a process, that is, the components are linked over time,
g) building on what has already been constructed, so that
h) it is not the components, but the components in linkage that constitute the causes. Points c) and f–h) together ensure that
i) it is difficult to partition relative importance or responsibility for an outcome among the different types of cause (e.g., 80% genetic vs. 20% environmental). Generally,
j) there are alternative routes to the same end, and
k) construction is "polypotent," that is, things involved in one construction process are implicated in many others. Engaging in a construction process, even in very focused interventions, will have side effects. Finally, points f) and k) mean that
l) construction never stops; completed outcomes are less end points than snapshots taken of ongoing, intersecting processes" (Taylor 2001).

Instructions

Pre-session reading:

Paul, D. (1997). Appendix 5. The history of newborn phenylketonuria screening in the U.S. Promoting Safe and Effective Genetic Testing in the United States. N. A. Holtzman and M. S. Watson. Washington, DC, NIH-DOE Working Group on the Ethical, Legal, and Social Implications of Human Genome Research: 137-159. http://biotech.law.lsu.edu/research/fed/tfgt/appendix5.htm

Excerpt from Taylor (2001 or 2004) on the development of severe depression in a sample of working class women.

Phase A: Mini-lecture to introduce the ideas under goals 1 and 2 and the use of diagrams to identify missing detail (goal 3). Illustrated with diagrams of a) the development of severe depression in a sample of working class women and b) the life-course of a female with PKU detected by neo-natal screening for PKU (based on Paul 1997) and perhaps other cases. Followed by Question & Answer.

Phase B: Following the procedure below, diagram Paul (1997) article with respect to the routinization of neo-natal screening for PKU in the United States. Followed by discussion of potential and limitations of the diagramming activity (for discussion among colleagues or for teaching).

1. Identify important connections mentioned in the article between things in the following categories or strands (open to adaptation): Experience of persons with PKU (condition, care, social support); Advocacy (pro + con); State mandates & regulation; Research; and Wider social context.

2. Arrange the things as well as you can given the information available on parallel strands according to year (from 1930s to 1990s allowing more space for 1960 through 1980).
3. Draw dotted lines to show connections between things.
4. Identify connections about which you want to know more. Use the ideas under goal 3 as a checklist.
5. Note where these instructions were hard to put into practice.

Example of connection: enthusiasm for biomedical prevention of mental retardation over education/social support/rehabilitation of retarded persons (wider social context) and promotion of PKU screening in advance of research on effects of diet (state mandates & regulation/ research).

6. Share products and comment on them on the blog

Phase C (Advanced): Move from developing categories to interconnected strands for the explanation given by a) Dickens and Flynn in APA (2001) for the generation-to-generation increase in IQ test scores; or b) Barker as described in Taylor (2004) for early-life origins of chronic diseases of later life.

4. Synthesis and extensions

Soil erosion case followed by themes about intersecting processes: Post 1, post 2, post 3

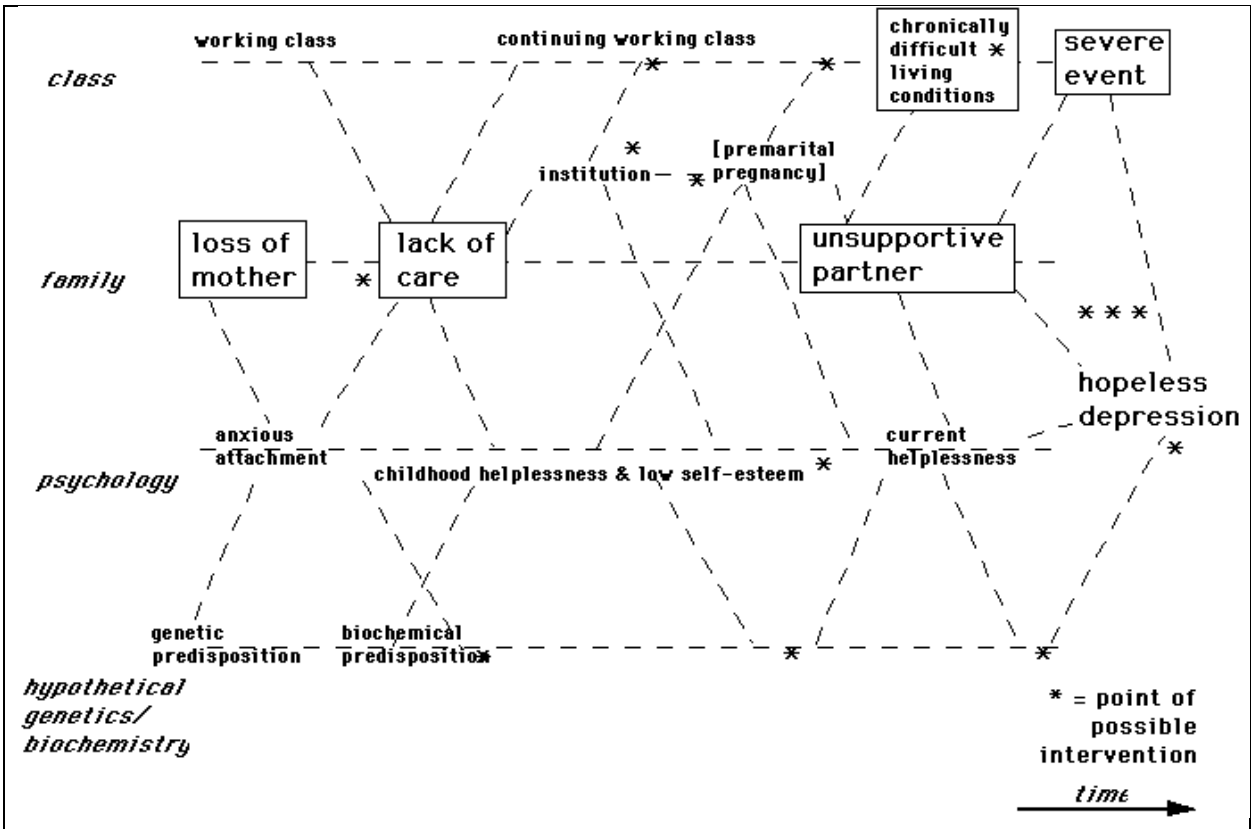
5. Connections and resources

- Whys to look for genes: Pros and complications--a compilation of series of blog posts

5b. Online forum, through which students can provide suggestions and resources for revising the chapter Add to this blog post to make contributions to the revision of the case or to an annotated collection of new readings and other resources related to the case.

5c. Adaptation of themes from the chapter to students' own projects of engaging others in learning or critical thinking about biology in its social context: Suggestions for how to do that:

- Choose a key reading related to your topic and lead your readers through the steps in making an intersecting processes diagram to discussion of insights to be gained from that
- Create a forum related to your topic in which participants contribute to a multi-level timeline (e.g., http://bit.ly/sftptime).
- Brainstorm with instructor



Adapted from Bowlby (1988, p. 177). His schema is, in turn, adapted from Brown and Harris (1978, p. 265). Hypothetical genetic/biochemical strand added by Peter Taylor.

An account of severe depression in working class London women

(from Taylor, P. J. (1995). Building on construction: An exploration of heterogeneous constructionism, using an analogy from psychology and a sketch from socio-economic modeling. *Perspectives on Science, 3*(1), 66-98.)

Consider the challenge of explaining some human behavioral characteristic, such as IQ, aggression, schizophrenia, sexuality, a food preference, and so on. The conventional wisdom is that nature and nurture interact to produce behaviors, just as they do for other human characteristics. It goes something like this: "We are not yet sure how much is genetic, how much is environmental; it will probably turn out to be some of both. Only extremists, motivated by some political agenda, insist that behaviors are 100% genetic or 100% environmental." Since the 1980s, however, the genetic contribution has been on the ascendant. The Minnesota study of twins raised apart, which eliminated many of the methodological shortcomings of earlier studies, has promoted the view that many behaviors have a more substantial genetic basis than previously thought—divorce rates, male homosexuality, depression, and many more (Bouchard et al. 1990; McGue and Lykken 1992). The possibility of molecular biology discovering genetic markers for various conditions has further enhanced the behavioral genetics program (Aldhous 1992) and strengthened the dichotomy of genetic versus environmental determination.

A less well-known body of research, initiated by the British sociologists Brown and Harris in the 1960s, has interpreted the social origins of mental illnesses in a way that undercuts this genes-environment dichotomization. This research suggests how apportioning behavior to genes or environment might not, at least for those seeking to reduce the incidence of mental illness, be very helpful. To see how this follows, let me sketch their explanation of acute depression in working-class women in London (Brown and Harris 1978, 1989). I will also work in the extensions of their findings made by Bowlby, a psychologist who focused on the long-term effects of different patterns of attachment of infants and young children to their mothers (Bowlby 1988).

Four factors are identified by Brown and Harris as disproportionately true of women with severe depression: a severe, adverse event in the year prior to the onset of depression; the lack of a supportive partner; persistently difficult living conditions; and the loss of, or prolonged separation from, the mother when the woman was a child (under the age of eleven). Bowlby interprets this last factor in terms of his and others' observations of secure versus anxious attachment of infants and young children to caregivers. In a situation of secure attachment the caregiver, usually the mother, is, in the child's early years, "readily available, sensitive to her child's signals, and lovingly responsive when [the child] seeks protection and/or comfort and/or assistance" (Bowlby 1988, p. 167). The child more boldly explores the world, confident that support when needed will be available from others. Anxious

attachment, on the other hand, corresponds to inconsistency in, or lack of, supportive responses. The child is anxious in its explorations of the world, which can, in turn, evoke erratic responses from caregivers, and the subsequent attempt by the child to get by without the support of others.

The three strands of the figure above (class, family, psychology) combine the observations above to explain the onset of serious depression. The factors are not separate contributing causes, like spokes on a wheel, but take their place in the multi-stranded life course of the individual. Each line should be interpreted as one contributing causal link in the development of the behavior. The lines are dashed, however, to moderate any implied determinism; the links, while common, do not apply to all women at all times, and are contingent on background conditions not shown in the diagram. For example, in a society in which women are expected to be the primary caregivers for children (a background condition), the loss of a mother increases the chances of, or is linked to, the child's lacking consistent, reliable support for at least some period. Given the dominance of men over women and the social ideal of a heterosexual nuclear family, an adolescent girl in a disrupted family or custodial institution would be likely to see a marriage or partnership with a man as a positive alternative, even though early marriages tend to break up more easily. In a society of restricted class mobility, working-class origins tend to lead to working-class adulthood, in which living conditions are more difficult, especially if a woman has children to look after and provide for on her own. In many such ways these family, class, and psychological strands of the woman's life build on each other.

Suppose now, quite hypothetically, that certain genes, expressed in the body's chemistry, predispose a child to being more anxious in attachment compared to other children, even those within the same family. Suppose also that this inborn biochemistry (or the subsequent biochemical changes corresponding to the anxiety) renders the child more susceptible to the biochemical shifts that are associated with depression. (This hypothetical situation is depicted in the bottom strand of the figure.) It is conceivable that early genetic or biochemical diagnosis followed by lifelong treatment with prophylactic antidepressants could reduce the chances of onset of severe depression. This might be true without any other action to ameliorate the effects of loss of mother, working-class living conditions, and so on. There are, however, many other readily conceivable interventions to reduce the chances of onset of depression, for example, counseling adolescent girls with low self-esteem, quickly acting to ensure a reliable caregiver when a mother dies or is hospitalized, making custodial institutions or foster care arrangements more humane, increasing the availability of contraceptives for adolescents, increasing state support for single mothers, and so on. If the goal is reduction in the incidence of severe depression for working-class women, the unchangeability of the hypothetical inherited genes says nothing about the most effective, economical, or otherwise socially desirable intervention (or combinations of interventions) to pursue.

This account of the origins of acute depression in working-class women displays most of the features [noted in the Introduction that are] associated with the idea that something is constructed:

- Many different kinds of components are linked together over time, each step building on what has already been constructed. This implies that:
- The outcome has multiple contributing causes, and thus:
- There are multiple points of intervention or engagement that could modify the course of development.

Recall that deterministic accounts, in contrast, tend in the opposite direction:

- The links between proposed causes and outcome are direct, e.g., severe depression is a biochemical imbalance.
- Few steps are involved in the construction and a single kind or small number of causes dominate.
- Few opportunities arise for things to have happened differently, in particular, social policy will not be able to change the outcome greatly.

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Intersecting processes, illustrated and analyzed

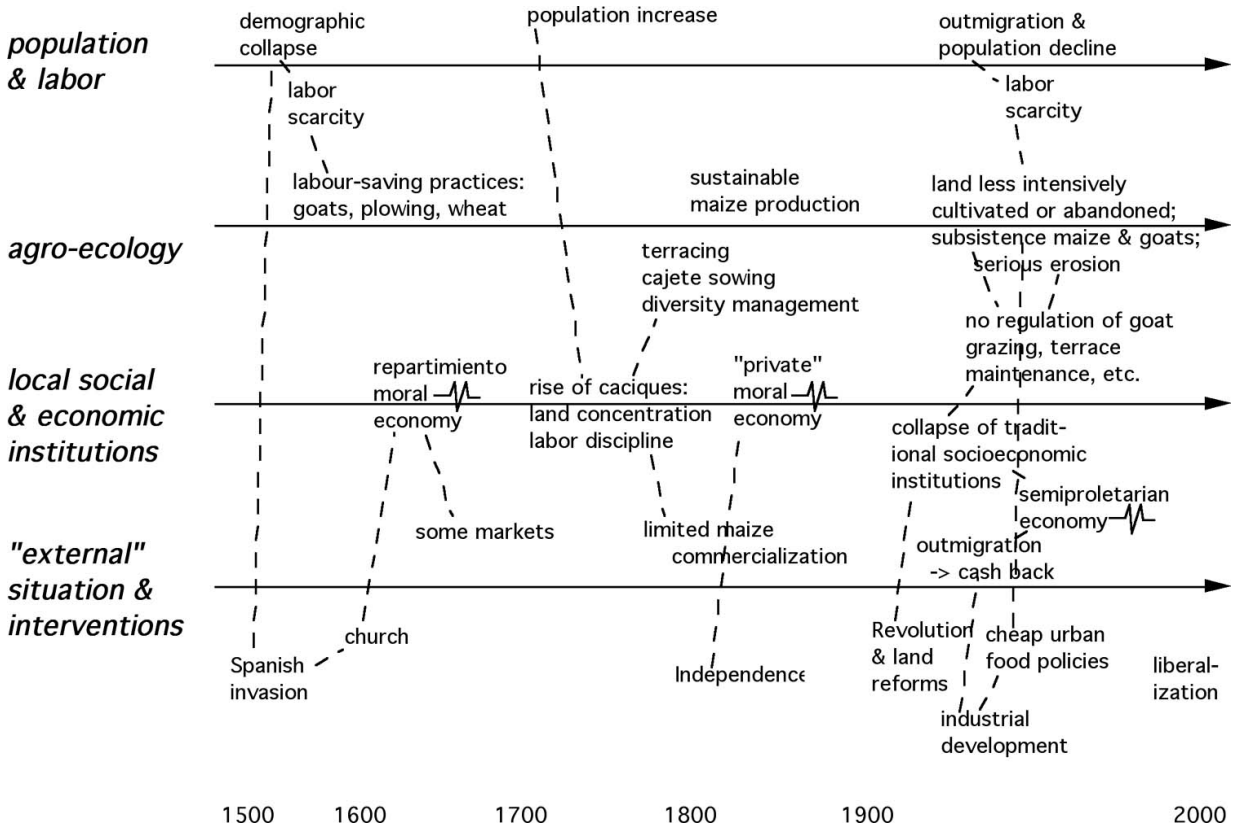
(Extracted from Taylor, Peter J. 2005. *Unruly Complexity: Ecology, Interpretation, Engagement*. U. Chicago Press.)

Intersecting processes is a term I use to help students and researchers conceptualize directions that would address… complexity in socio-environmental studies... The term addresses the [need] to analyze social and environmental change as something produced by intersecting economic, social and ecological processes that operate at different scales requires attention to the ways these processes transgress boundaries and restructure "internal" dynamics, thus ensuring that socio-environmental situations do not have clearly defined boundaries and are not simply governed by coherent, internally driven dynamics… I use the term intersecting processes to suggest that different strands can be teased out in a somewhat disciplined fashion. This will be evident in the following presentation of a case of soil erosion in a mountainous agricultural region in Oaxaca, Mexico, which I have based on the analysis of Mexican colleagues Raúl García-Barrios and his brother Luis (García-Barrios and García-Barrios 1990).

The severe soil erosion evident now in the municipality of San Andrés is not the first occurrence of such a problem in the region. After the Spanish conquest, when the indigenous population collapsed from disease, the communities abandoned their terraced lands, which then eroded. The remaining populations moved to the valleys and adopted laborsaving practices from the Spanish, such as cultivating wheat and using plows. As the population recovered during the eighteenth and nineteenth centuries, collective institutions evolved that reestablished terraces. Erosion was reduced, soil dynamics were stabilized, and perhaps some soil accumulation was stimulated. But this type of landscape transformation needed continuous and proper maintenance. If a terrace were allowed to erode the soil would wash down and damage lower terraces; there was the potential for severe slope instability. What made the necessary maintenance possible were collective institutions, which first revolved around the Church and then, after independence from Spain, around rich Indians called caciques. These institutions mobilized peasant labor for key activities—not only maintaining terraces, but also sowing corn in work teams and maintaining a diversity of maize varieties and cultivation techniques. The caciques benefited from what was produced, but were expected to look after the peasants in hard times, a so-called moral economy (Scott 1976). Given that the peasants felt security in proportion to the wealth and prestige of their cacique, and given that prestige attached directly to each person's role in the collective labor, the labor tended to be very efficient. In addition, peasants were kept indebted to caciques, and could not readily break their unequal relationship. The caciques insulated this relationship from change by resisting potential laborsaving technologies and ties to outside markets in maize.

The Mexican revolution ruptured the closed system of reciprocal obligations and benefits by taking away the power of the caciques and opening the communities to the changing outside world. Many peasants migrated to industrial areas, sending cash back or bringing it with them when they returned to the community for periods of time. Rural population declined; transactions became monetarized; and prestige no longer derived from one's place in the collective labor. With the monetarization and loss of labor, the collective institutions collapsed and terraces began to erode. National food-pricing policies favored urban consumers, which meant that corn was grown only for subsistence needs in this area. Little incentive remained for intensive agricultural production. New laborsaving activities, such as goat herding, which contributes in its own way to erosion, were taken up without new local institutions to regulate them.

This is a diagram I drew to help me narrate this story to others and to highlight a number of themes pertaining to intersecting processes, which will be reviewed below.



Intersecting processes leading to soil erosion in San Andrés, Oaxaca. The dashed lines indicate connections across the different strands of the schema. The zig-zag lines indicate institutions that rely on relationships of inequality. See text for discussion.

1. Intersecting processes involve inseparable dynamics. Processes of different kinds and scales, involving heterogeneous elements, are interlinked in the production of any outcome and in their own on-going transformation. Each is implicated in the others (even by exclusion, such as when caciques kept maize production during the nineteenth century insulated from external markets). Notice especially the relationship between environmental degradation and the population decline shown in the top strand. This association can be used to grab the attention of environmentalists who identify population growth as a major environmental issue. However, it is neither population decline nor growth, but labor that was important in this case. Labor is something defined by the technologies of production (the second strand) and the social institutions that govern it. Such institutions operate both locally (the third strand) and at places distant from where the erosion occurs (the fourth strand). In short, the relationship between population and environmental change was highly mediated, depending on the technologies used and the local and national social and economic institutions through which labor and production were organized. No one kind of thing, no single strand on its own, is sufficient to explain the currently eroded hillsides. (This theme can be extended to call into question other explanations for environmental degradation that center on a single dynamic or process, e.g., climate change in erosive landscapes; increasing capitalist exploitation of natural resources; or modernization of production methods.)

The theme of inseparable dynamics can be teased out into four aspects:

2. In intersecting social-environmental processes, differentiation among unequal agents is implicated. Sustainable maize production depended on a moral economy of cacique and peasants, and the inequality among these agents resulted from a long process of social and economic differentiation. Similarly, the demise of this agro-ecology involved the unequal power of the State over local caciques, of urban industrialists over rural interests, and of workers who remitted cash to their communities over those who continued agricultural labor.

3. Heterogeneous elements and scales are involved. The situation has involved processes operating at different spatial and temporal scales, involving elements as diverse as the local climate and geo-morphology, social norms, work relations, and national political economic policy;

4. Historical contingency is significant. The role of the Mexican revolution in the collapse of nineteenth-century agro-ecology reveals the contingency that is characteristic of history. The significance of such contingency rests not on the event of the revolution itself, but on the different processes, each having a history, with which the revolution intersected; and

5. Structuredness is not reducible to micro- or macro-determinations. Although there is no reduction to macro- or structural determination in the account of soil erosion, the focus is neither on local, individual-individual transactions nor on the complex patterns produced by multiple simple

transactions. Regularities, e.g., the terraces and the moral economy, persist long enough for agents to recognize or abide by them. That is, structuredness is discernable in the intersecting processes.

The synopsis of a case of soil erosion in Oaxaca has, in addition to the themes above, a number of implications for thinking about the agency of the people studied and, reflexively, of researchers reconstructing intersecting processes:

6. The account represents agency as distributed across different kinds of agents and scale, not something centered in one class or place (Thompson 2002). In the nineteenth-century moral economy caciques exploited peasants, but in a relationship of reciprocal norms and obligations. Moreover, the local moral economy was not autonomous—the national political economy was implicated, by its exclusion, in the actions of the caciques that maintained labor-intensive and self-sufficient production. Although the Mexican revolution initiated the breakdown in the moral economy, the ensuing process involved not just political and economic change from above, but also from below and between—semi-proletarian peasants brought their money back to the rural community and reshaped its transactions, institutions, and social psychology.

7. The account has an intermediate complexity—neither highly reduced, nor overwhelmingly detailed. The elements included in my synopsis and in the diagram are heterogeneous, but I tease out different strands. The strands, however, are cross-linked; they are not torn apart. By acknowledging this intermediate level of complexity, the account steps away from debates centered on simple oppositions, e.g., ecology-geomorphology vs. economy-society, or ecological rationality vs. economic rationality. Similarly, by placing explanatory focus on the ongoing, intersecting processes, the account discounts the grand discontinuities and transitions that are often invoked, e.g., peasant to capitalist agriculture, or feudalism to industrialism to Fordism to flexible specialization.

8. Intermediate complexity accounts favor the idea of multiple, smaller engagements linked together within the intersecting processes. My synopsis and diagram of the García-Barrioses' more detailed account can be read as an engagement with current scholarly discourses in an effort to promote the concept of distributed agency. This concept has implications not only for how environmental degradation is conceptualized, but also for how one responds to it in practice. Intersecting processes accounts do not support government or social movement policies based on simple themes, such as economic modernization by market liberalization, sustainable development through promotion of traditional agricultural practices, or mass mobilization to overthrow capitalism.

9. This shift in how policy is conceived suggests a corresponding shift in scholarly practice. On the level of research organization, intersecting processes accounts highlight the need for trans-disciplinary work grounded in particular locations. They do not underwrite the customary multi-disciplinary projects

directed by natural scientists, nor the economic analyses based on the kinds of statistical data available in published censuses.

10. Finally, the intermediate complexity of the Figure preserves a role for some kind of social scientific generalization. The synopsis and diagram abstract away an enormous amount of detail, a move that suggests that the particular case described by the García-Barrioses might be relevant to other cases. The account does not provide a general explanatory schema, but at least could serve as a template to guide further studies. Such a template would be elaborated in new research projects once researchers began to address the particularities of the situation they are studying. In other words, the particularities of each case would not warrant starting from scratch when attempting to understand and engage in socio-environmental change. The intermediate complexity of my account also means—and here I am applying some reflexivity to my own representational work—that I have deflected attention away from the need to examine the particular institutional and personal resources, agendas, and alliances that people like me would have to cultivate to gain support for the desired trans-disciplinary research or policy interventions.

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