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Summary/ Abstract: This is a summary and review of Gintis' major thesis of gene-culture co-evolution.

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A Summary and Review of Gintis' Gene-culture Co-evolution Theme

(I) Gene-Culture Evolution

(A) Abstract

Gintis made 3 claims:

- 1) There is gene-culture co-evolution (GCC) (not one dictating on the other)
- 2) Co-evolution as niche construction
- 3) GCC leads to sociality (otherness, fairness, empathy – morality)

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Review

**Gene–culture coevolution and the nature
of human sociality**

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Human characteristics are the product of gene–culture coevolution, which is an evolutionary dynamic involving the interaction of genes and culture over long time periods. Gene–culture coevolution is a special case of niche construction. Gene–culture coevolution is responsible for human other-regarding preferences, a taste for fairness, the capacity to empathize and salience of morality and character virtues.

Keywords: gene–culture coevolution; sociobiology; epistatic information transfer

(B) An Ambitious Attempt(大膽搭橋)

Gintis tries to bridge genes with culture, leading to human values (cooperation, fairness, empathy, value, honesty, hard work and loyalty)

R: How to sustain his claim { describe mechanism?
historical evidence?

Underlying challenge – How to define elusive terms, some from philosophy, others from sociology, psychology (issue of hermeneutics)

(C) Culture is constrained and promoted by human genome

Because culture is both constrained and promoted by the human genome, human cognitive, affective and moral capacities are the product of an evolutionary dynamic involving the interaction of genes and culture. We call this dynamic *gene-culture coevolution* [1-4].

R: (1) Culture is constrained by genome – example

Humans can't fly; no wings – genome

We don't live in a 3-D society

(2) Culture is promoted by genome

Mating: we develop elaborated courting, wedding, family with reproductive function.

First, we have the genome (instinct) for mating. Then we develop culture with rituals to promote mating, which, at the same time, creates social organizations and norms.

(3) Evolutionary dynamic of genes - culture

Probably language development and tool making are responsible for intelligence, so that cognitive, affective and moral capacities (CAM) develop.

(4) Shared intentionality of mind

Other species share herd behavior, no mind.

(D) Sociobiology as niche construction

This is a special case of *niche construction*, which applies to species that transform their natural environment so as to facilitate social interaction and collective behaviour [5].

R: Sure. But who knows a niche (of primates, homo sapiens) can transform the whole planet? Marvels! It is even changing gene-coding!

(E) The function of genome encoding and learning

The genome encodes information that is used both to construct a new organism and to endow it with instructions for transforming sensory inputs into decision outputs. Because learning is costly and time-consuming, efficient information transmission will ensure that the genome encodes those aspects of the organism's environment that are constant, or that change only very slowly through time and space,

Feeding / temperature thought experiment.

R: Gintis seems to argue:

(1) An organism will modify its gene code to adapt to environment. (coldness
→ more hair to preserve heat)

(2) But this is not always the case:

My interpretation:

Genetic encoding will modify only when beneficial to survival / fitness. If environment is relatively stable, there is no need to modify. Adaptation can be taken care of it by learning. There is phenotypic plasticity (?), capacity to learn.

(F) Epigenetic / cultural transmission

When environmental conditions are positively but imperfectly correlated across generations, each generation acquires valuable information through learning that it cannot transmit genetically to the succeeding generation, because such information is not encoded in the germ line. In the context of such environments, there is a fitness benefit to the *epigenetic* transmission of information concerning the current state of the environment; i.e. transmission through non-genetic channels. Several epigenetic transmission mechanisms have been identified [6], but *cultural transmission* in humans and to a lesser extent in other animals [7,8] is a distinct and extremely flexible form.

R: Here cultural transmission is more like learning.

(G) History of cultural – biological evolution

Huxley → James → Popper → Dawkins (meme – selfish gene)

Summarized by Mesoudi et al (2006)

17 Mesoudi, A., Whiten, A. & Laland, K. N. 2006
Towards a unified science of cultural evolution. *Behav.
Brain Sci.* 29, 329–383. (doi:10.1017/S0140525X
06009083)

(H) Cultural reproduction like genes

R: This is a concept of cultural reproduction by replication, evolution, mutation, selection, etc. While we should caution about the validity and usefulness in

borrowing concepts, it is already done by anthropologists and paleobiologists.

Because of their common informational and evolutionary character, there are strong parallels between models of genetic and cultural evolution [17]. Like biological transmission, culture is transmitted from parents to offspring, and like cultural transmission, which is transmitted horizontally to unrelated individuals, so in microbes and many plant species, genes are regularly transferred across lineage boundaries [6,24,25]. Moreover, anthropologists reconstruct the history of social groups by analysing homologous and analogous cultural traits, much as biologists reconstruct the evolution of species by the analysis of shared characters and homologous DNA [26].

Indeed, the same computer programs developed by biological systematists are used by cultural anthropologists [27,28]. In addition, archeologists who study cultural evolution have a similar *modus operandi* as palaeobiologists who study genetic evolution [17]. Both attempt to reconstruct lineages of artifacts and their carriers. Like palaeobiology, archaeology assumes that when analogy can be ruled out, similarity implies causal connection by inheritance [29]. Like biogeography's study of the spatial distribution of organisms [30], behavioural ecology studies the interaction of ecological, historical and geographical factors that determine distribution of cultural forms across space and time [31].

(I) Niche construction – Beaver dam, beehives, Nests

Gintis gave an example of social structure of hive.

An excellent example of gene–environment coevolution is the honeybee, in which the origin of its eusociality probably lay in the high degree of relatedness fostered by haplodiploidy, but which persists in modern species despite the fact that relatedness in the hive is generally quite low, due to multiple queen matings, multiple queens, queen deaths and the like [33–35]. The social structure of the hive is transmitted epigenetically across generations, and the honeybee genome is an adaptation to the social structure laid down in the distant past.

R: Need to go deep

(J) Hunter gatherer social structure with otherness – Evidence of Moral Intelligence

- (1) Gintis' critique on economic theory of co-operation by self-regarding rational agents.

(2) Brain modality on morality

The evolution of the human prefrontal cortex is closely tied to the emergence of human morality [46]. Patients with focal damage to one or more of these areas exhibit a variety of antisocial behaviours, including the absence of embarrassment, pride and regret [47,48], and sociopathic behaviour [49]. There is a probable genetic predisposition underlying sociopathy, and sociopaths comprise 3–4% of the male population, but they account for between 33 and 80 per cent of the population of chronic criminal offenders in the United States [50].

R: another evidence for 9th intelligence (moral intelligence)!

(II) Culture as By-product of Genetic Evolution: A Critique

See ideas 946

(III) Gene-Culture Co-evolution: Physiology of Communication

R: short and clear summary of development of speech and facial communication
development of tongue muscles, speech muscles, facial skin

In short, humans have evolved a highly specialized and very costly complex of physiological characteristics that both presuppose and facilitate sophisticated aural and visual communication, whereas communication in other primates, lacking as they are in cumulative culture, goes little beyond simple calling and gesturing capacities. This example is quite a dramatic and concrete illustration of the intimate interaction of genes and culture in the evolution of our species.

Yes, it is the drama of the birth of human species!

(IV) Internalization of Norms

(A) Genetic disposition

The internalization of norms, of course, presupposes a genetic predisposition to moral cognition that can be explained only by gene–culture coevolution.

R: Gintis uses “genetic predisposition” here. It is the only way we can connect “genes” with culture and morality.

(B) Socialization theory and values

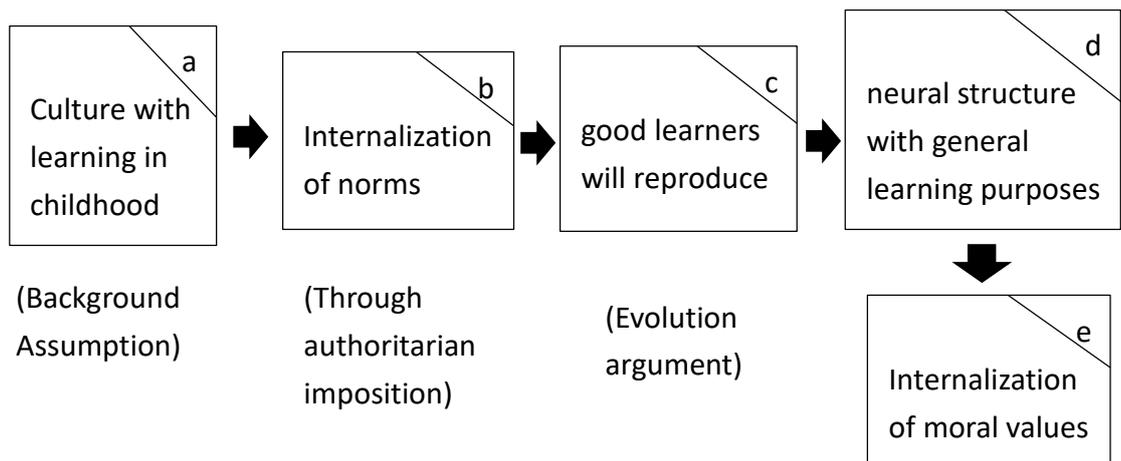
R: These are Gintis’ research on the emergence and abandonment of values based on survival / fitness (ref 53, 67) and inexplicable change of values (ref 68, 69). Also research in altruistic behavior (ref 70 - 72)

- 67 Gintis, H. 2003 Solving the puzzle of human prosociality. *Rationality Soc.* **15**, 155–187. (doi:10.1177/1043463103015002001)
- 68 Gintis, H. 1975 Welfare economics and individual development: a reply to Talcott Parsons. *Q. J. Econ.* **89**, 291–302. (doi:10.2307/1884434)
- 69 Wrong, D. H. 1961 The oversocialized conception of man in modern sociology. *Am. Soc. Rev.* **26**, 183–193. (doi:10.2307/2089854)
- 70 Camerer, C. 2003 *Behavioral game theory: experiments in strategic interaction*. Princeton, NJ: Princeton University Press.
- 71 Gintis, H., Bowles, S., Boyd, B. & Fehr, E. 2003 Explaining altruistic behavior in humans. *Evol. Hum. Behav.* **24**, 153–172. (doi:10.1016/S1090-5138(02)00157-5)
- 72 Gintis, H. 2000 Strong reciprocity and human sociality. *J. Theor. Biol.* **206**, 169–179. (doi:10.1006/jtbi.2000.2111)

(C) Gintis' scenario of genetic disposition

Gintis [53] provides a plausible evolutionary scenario in which the genetic predisposition to internalize norms may have developed. The prerequisite is a cultural system sufficiently complex that the learning process for youth in acquiring facility with this system extends throughout childhood, and hence takes the form of an authoritarian imposition carried out by elders. Because the skills acquired in this manner (e.g. hunting, recognizing and preparing nutritious foodstuffs) do not have immediate intrinsic payoffs for the learner, those who respond to the rewards and sanctions of teachers will reproduce at the expense of those who do not. Internalizing the norms associated with instrumental skills will then be directly fitness-enhancing, and hence the neural structures that support internalization will be privileged in human evolution. Once these neural structures are in place, they can be deployed for more general purposes, including internalizing moral values and deriving pleasure from helping others and punishing those who act contrary to social norms.

R: His line of thought:



R: If d happens, it is natural selection of learning potential for all things, not necessarily norms.

R: Interestingly, Egan also proposes general learning capacity (1997)

R: His argument looks slippery

- (1) Lamarckism in reproduction
- (2) Terms are used freely (隨意地)(general learning purposes)
- (3) No explanation of how "internalization" goes on
- (4) Jumping from learning skills (e.g. hunting) to learning values (e.g. food rationing). How and why did it happen?

(V) Altruism

(A) Game-theory induced research findings on altruism

Many empirical findings from behavioural game theory [70] show that human subjects regularly exhibit altruistic behaviours towards enhancing cooperative payoffs [42, ch. 4]. Indeed, it is likely that such altruistic predispositions account for the remarkable evolutionary success of our species [64]. Among such predispositions are the character virtues (honesty, courage, trustworthiness, considerateness and the like) and strong reciprocity, which is a predisposition to cooperate with others in a collective task, and to

R: Good to learn of this line of game-theory research, I tend to think it can somewhat generalize because many altruistic acts are immediate and impulsive, not deep contemplation. A member acting altruistically to save a group or another member is but human nature (instinct, genetic predisposition), and this induced similar behavior (herd psychology).

(B) Problem of definition in altruism

- (1) Gintis admits the problem.
Payoffs in evolution = gaining of fitness
- (2) Gintis mentioned “altruism as emergent property” in this section’s sub-heading but there is no explanation nor elaboration here.

(C) Mal-adaptation and mental confusion argument

Thus, altruistic cooperation and punishment, they argue, stem from mental confusion due to the difficulty in avoiding detection when behaving anti-socially in our evolutionary past. Throughout most of the history of our species, they argue, hunter-gatherer societies offered little room for the sorts of anonymous interaction and covert behaviour found in modern society [75,76]. Because of our evolutionary past, they argue, modern humans are hyper-sensitive to even remote possibilities that their actions may be observed and their reputations sullied.

R: It leads to another interesting issue:
Why concern of “privacy” in the west but not the east? What cultural difference?

(D) Non-human primates

Non-human primates in hunter-gatherer group do not show altruistic co-operation.

R: What does it mean? Altruistic co-operation as human specific?

(E) Research on dictator game theory

As to the degree of altruistic giving in this experiment, Andreoni and Miller found that 22.7 per cent of subjects were perfectly selfish, 14.2 per cent were perfectly egalitarian at all prices, and 6.2 per cent always allocated all the money so as to maximize the total amount won (i.e. when $p > 1$, they kept all the money, and when $p < 1$, they gave all the money to the receiver).

(F) Research on ultimatum game

(VI) Altruism with Experimental Evidence

(A) Gintis' most significant claim

Morality is an emergent property of the gene–culture evolutionary dynamic that gave rise to our species.

(1) R: If one claims “emergent property”, it must be something new ($H_2 + O = H_2O$).

Here morality is part of culture. A suggested revised claim will be:

Genetic disposition favors sociality and co-operation, leading to the emergence of morality and culture

(2) R: Gintis starts from economics and is critical of “rational choice”. In my mind, the old “Economic Man” has long been dead. We need more realistic and sophisticated assumptions.

(B) Morality vs Rationality

Gintis' another line of thought of contrasting morality with rationality

Moral behaviour is often held to be incompatible with rational choice. This is incorrect.

R: He tried to measure morality (such as honesty) loyalty with economic value (such as fried chickens)

(C) Rational choice in BPC model

we often call the rational actor model the *beliefs, preferences and constraints* model (BPC), because this captures the notion of consistent preference, the centrality of beliefs and the notion of making trade-offs subject to informational and material constraints.

In the BPC model, choices give rise to probability distributions over outcomes, the expected values of which are the payoffs to the choice from which they arose.

(D) Game theory assumption

Game theory predicts the behaviour of the players by assuming each is rational; in other words, each maximizes a preference function subject to beliefs as well as informational and material constraints.

(E) Game Theory Experiments

- (1) Social dilemma
- (2) Conditional altruistic co-operation
- (3) Prisoner's dilemma of "simultaneous" and "second-player" treatment
- (4) Public goods game
- (5) Public goods game with and without punishment

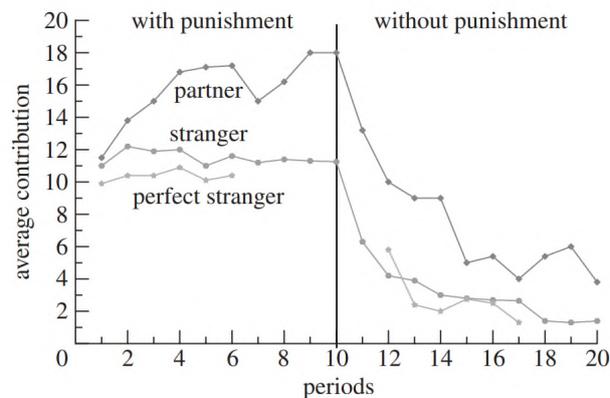


Figure 2. Average contributions over time in the partner, stranger and perfect stranger treatments when the punishment condition is played first [82].

Their results are illustrated in figure 2. We see that when costly punishment is permitted, cooperation does not deteriorate, and in the partner game, despite strict anonymity, cooperation increases almost to full cooperation even in the final round. When punishment is not permitted, however, the same subjects experienced the deterioration of cooperation found in previous Public Goods Games.

R: It is an interesting area. My interpretation of the graph:

- (a) Clear tendency of co-operation (rejection of individual economic agent).
- (b) To improve co-operation, punishment is needed.

(F) Character virtues

(1) Gintis' definition

Character virtues are ethically desirable behavioural regularities that individuals value for their own sake, while having the property of facilitating cooperation and enhancing social efficiency. Character virtues include *honesty, loyalty, trustworthiness, promise-keeping* and *fairness*. Unlike such other-regarding preferences as strong reciprocity and empathy, these character virtues operate without concern for the individuals with whom one interacts. An individual is honest in his transactions because this is a desired state of being, not because he has any particular regard for those with whom he transacts.

(2) Experiment on honesty

Common sense, as well as the experiments described below, indicates that honesty, fairness and promise-keeping are not absolutes. If the cost of virtue is sufficiently high, and the probability of detection of a breach of virtue is sufficiently small, many individuals will behave dishonestly.

Numerous experiments indicate that most subjects are willing to sacrifice material rewards to maintain a virtuous character even under conditions of anonymity.

(3) Verbal agreement as predictor of co-operation

Sally [97] undertook a meta-analysis of 137 experimental treatments, finding that face-to-face communication, in which subjects are capable of making verbal agreements and promises, was the strongest predictor of cooperation. Of course, face-to-face interaction violates anonymity and has other effects besides the ability to make promises. However, both Bochet *et al.* [98] and Brosig *et al.* [99] report that only the ability to exchange verbal information accounts for the increased cooperation.

R: (a) There may be racial / cultural difference in verbal agreement.

(b) Even an agreement is subject to different interpretation.

(c) Experiment supports that this simple rule: Communication is important; exchange of verbal information increases co-operation.

(4) Experiments to study telling lies

This shows that many subjects are willing to sacrifice material gain to avoid lying in a one-shot anonymous interaction, their willingness to lie increasing with an increased cost to them of truth telling, and decreasing with an increased cost to their partners of being deceived.

(VI) Gintis' Conclusion and My Review

(A) His conclusion

7. CONCLUSION

Population biology traditionally takes the environment as exogenous. However, we know that life-forms affect their own environment and the environments they produce change the pattern of genetic evolution they undergo. Niche construction augments population biology by rendering environmental change itself part of the evolutionary dynamic. Gene-culture coevolution is the application of niche-construction reasoning to the human species, recognizing that both genes and culture are subject to similar dynamics, and human society is a cultural construction that provides the environment for fitness-enhancing genetic changes in individuals. The resulting social system is a complex dynamic non-linear system. Such systems have *emergent properties*, some of which have been analysed in this paper: social norms, morality, other-regarding preferences and the internalization of norms.

Symbiotic / transaction thesis: surely human species create culture.

No, genes and culture are subject to not-so-similar dynamics.

It is not necessary to put the case this way. Rather, culture has its own dynamics and property, which are remotely related to genes.

(B) Inspiration from Gintis

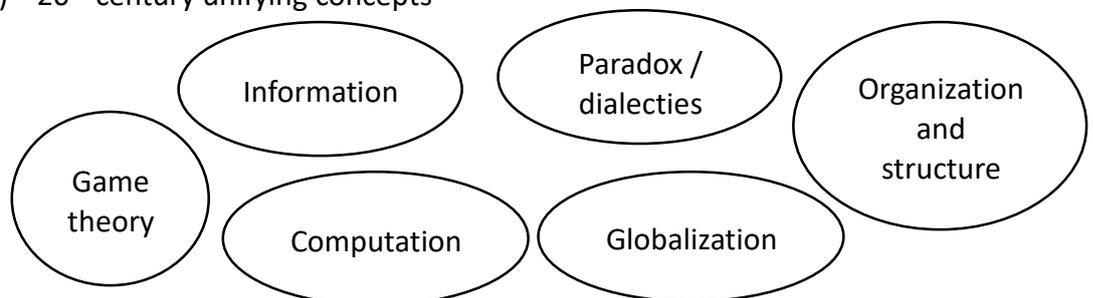
- (1) How far can scientific method study morality / human nature? We witness the colonization of science and mathematics (logic) to humanities in the 20th Century.

When science, in pursuit of principles and theories, is applied on science, Heisenberg discovered uncertainty.

Science on science → uncertainty principle (1926) → what next?

(1926)

- (2) 20th century unifying concepts



- (3) The need of Taxonomy of morality / values / emotion
- (4) Multiple intelligence to add moral intelligence.
- (5) Altruism is impulsive
- (6) Privacy issue affects behavior

(C) My view: from Gene to Morality

The earth environment is the background factor, giving rise to life. Gene-coding is the background factor, giving rise to evolution and survival of species. Primate gene-coding is the background factor, giving rise to physical structure within an entity, (body) that gives rise to making sounds (Some species don't make sounds). Modification of the physical structure gives rise to speech, for communication and social collective action, which, in interaction with other factors, such as tool-making, communal living, cultural artifacts, give rise to intelligence (conceptual understanding, thought and thought-directed action). Only with that can cognitive, affective and moral capacities (CAM) develop.

In this drama of homo species' rise to supremacy, it is speculated that the important of genes declines with the rise of speech and culture. The argument of genes leading to morality may not be necessary. Rather genes and environment co-evolves in primates, leading to modification of physical structure and speech. Afterwards, it is intelligence and morality, another page of human history.

(D) Opening more issues for research

Gintis' paper leads to more issues than answers. It means more study / research in the following:

- (1) Dawkins (1976) *Selfish Gene*
A whole line of research from Huxley to James, Popper summarized in Mesoudi (2006).
- (2) Gintis
His study on sociality, reciprocity and altruism, human nature.
- (3) Game Theory
From prisoner's dilemma to Dictator to Ultimatum. How they study economic and value.
- (4) Beehive study
How it is not useful in evolution
- (5) Face muscle evolution
A unique feature / development of homo species.
- (6) No-altruism found in non-primate
- (7) Privacy issue
The social dimension of Game theory.