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THE HIERARCHICAL COMPLEXITY VIEW OF EVOLUTION AND HISTORY

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Evolution means different things at different stages of development. Higher stage explanations for it are downward assimilated at lower stages. Different scientific explanations for evolution also reflect different stages of development. Hierarchical complexity of tasks in evolution is a behavioral analytic explanation. It is selection processes of various kinds in tandem with changes in selection tasks' orders of hierarchical complexity. There is neither teleology nor evolutionary favoring of the highest stages of performance. Selection tasks at higher orders of complexity increasingly decenter at all scales of behaviors from thought to history's social periods. These processes account for sociopolitical conflicts over evolution.

KEYWORDS: Behavioral analysis, decenter, evolution, selection, hierarchical complexity, history, periods, sociopolitical.

The Model of Hierarchical Complexity is a general theory that applies to evolution and history. The orders of hierarchical complexity are mathematical explanations that may be applied to account for how organisms and groups of organisms evolve. Because the orders are mathematical abstractions, it is useful to recount events from our shared history of evolution to explicate them. In doing so, it is also useful to briefly consider conceptions of the term, evolution. Evolution's evidence illustrates the orders of hierarchical complexity operating over vast time scales. The evidence cannot be understood outside of increases in stage of performance on increasingly more hierarchically complex tasks. Other articles in this special issue discuss aspects *of* evolution; by contrast, this article addresses evolution itself, and therefore also history.

To do so, objectives for this article are to (1) introduce the hierarchical complexity account of some meanings associated with the term *evolution*, (2) give the hierarchical complexity view of evolution itself, (3) show the inherent *decentering* behavioral pattern evidenced in every increase in hierarchical complexity,

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regardless of task-performer or time scale, and (4) associate techniques of analyzing events that transpired over long time scales with their orders of hierarchical complexity, in order to illustrate comparable patterns of behavior in all areas of human history.

"EVOLUTION"

In some places, "evolution" is a source of social and political controversy. The evolutionary account presented in this article suggests why that is the case. At the same time, it seems fitting to begin by addressing the term itself. As is the case with many other concepts, *evolution* is subject to disparate meanings (see "Postformal (Mis)Communications," this issue). This is because the *use* of a term is a *task* one performs. The task of using the term is performed at a particular stage of development, which reflects a given order of hierarchical complexity. When stages differ, meanings may differ as a result. Just so, to explain a term is also a task. Both the tasks of using and explaining a term are discussed, beginning with that of explanation.

Evolution is a postformal concept. Two explanations for the evolutionary process are given next to demonstrate this. They include bracketed hierarchical complexity stage scores at the end of each statement. The final statement in each explanation successfully completes the task of coordinating the explanation as a whole. The stage score of the thus-completed task is given at the end of each.

Explanation A: A Systematic Stage 11 Explanation of Evolution

1. There is the change in the inherited traits of a population. [relations among variables, formal 10] 2. These traits are the expression of genes in interaction with the environment. [relations among variables, formal 10] 3. During reproduction, these genes are copied and passed on to offspring. [relations among variables, formal 10] 4. Gene mutations may alter traits if the organism survives. [relations among variables, formal 10] 5. This results in heritable differences between the previous organisms and the present ones. [a system of formal relations, Systematic stage 11; it coordinates all of the formal relations identified]

Explanation B: A Metasystematic Stage 12 Explanation of Evolution

1. Another mechanism is the transfer of genes between populations, as in migration [a system, systematic 11] 2. or between species, as in horizontal gene transfer [a system, systematic 11] 3. These occur either non-randomly through natural selection [a system, systematic 11] 4. or randomly through genetic drift [a system, systematic 11] 5. Evolution occurs when these heritable differences become more common or rare in a population for either of these reasons. [the comparison and coordination of multiple systems, Metasystematic stage 12; it coordinates all of the systems in correct relation to one another in 1 through 4]

Persons performing the task of using the term *evolution* at Formal stage 10 and Abstract stage 9 *cannot mean* either of the aforementioned explanations because

they cannot perform *those* tasks at *those* higher orders of hierarchical complexity. If they use the term, they refer to it by downward assimilation (for explanation, see "Cultural Progress is the Result of Developmental Level of Support," this issue). This behavior is one account of the occurrence of different meanings: the lower stages of performance coordinate tasks of lower orders of hierarchical complexity because they are the only kinds of task-actions to which they have access. Examples in what follows show how one may develop a meaning for *evolution*, first possible at Abstract stage 9 and Formal stage 10.

Begin with Concrete 8 elements: (8a) "Noah picked good animals for his ark." (8b) "God told him to do it to save them from the flood." (8c) "The animals left off the ark died in the flood." From coordinating 8a, 8b, and 8c, the *Abstract 9 assertion* may result: "The best always survive."

Begin with Abstract 9 elements: (9a) "Humans used to look like they descended from apes." (9b) "Lots of animals look a lot different than they did a long time ago." From coordinating 9a and 9b, the *Formal 10 logical conclusion* may result: "There is change in the inherited traits of a population."

The first example indicates how the notion "survival of the fittest" may be downward assimilated as "the best always survive." Making deductions are common behaviors in downward assimilations of higher stage notions. A Formal stage 10 assimilation may result in the linear deduction that "the fittest" are "the highest" and therefore the highest are "special" in some way. At all stages, people develop explanations for how things "work," including such notions as evolution and human nature. If an explanation happens to be that animals such as humans, cattle, or dogs have some special status, the reason for the status is accounted for somehow at the cultural and/or individual level (see later explanation).

THE HIERARCHICAL COMPLEXITY VIEW OF EVOLUTION

Because hierarchical complexity is mathematically based, it involves no content: it accounts for behaviors that result in different content. For this reason, the hierarchical complexity view is that evolutionary processes are attributable to selection processes of various kinds and changes in stage of performance related thereto (see "Selectionism and Stage Change," this issue). The processes of evolution do not favor any particular organism, any particular order of hierarchical complexity, or any particular degree to which a given order is present.

This view is a behavioral analytic support of the Darwinian view that there is no inherent teleology that favors "higher." For example, the number of organisms that function at Sensory or Motor Stage 1 exceed those of any other organisms. These include animals, plants, and other organisms of all sizes (e.g., bacteria, cells, proteins within cells). Their collective physical mass also exceeds that of higher stage organisms. For example, the Antarctic krill species (Circular Sensory-motor stage 2) comprises 0.66 percent of the biomass on Earth, the largest proportion of any other animals' representation in biomass (Nicol and Endo, 1997). As one considers organisms' behaviors at each increasing order of hierarchical complexity, there are fewer and fewer at higher orders, until we consider humans. There is no teleology in selectionism and stage change processes that says "smarter"

organisms will prevail. Nonetheless, when we examine humans, they appear to prevail over other organisms. This seems to reflect a general rule about evolution. We know social animals tend to perform at higher stages than their nonsocial relatives. The human situation is unique because humans are the first animal that, in a planned manner, select other animals through husbandry and fauna through agriculture and other activity. Humans are able to out-compete with other animals by hunting and eliminating their habitats. Their higher stages of performance mean human organisms are highly energy-dependent, even for reasoning, as cognitive thermodynamics and other laws suggest. To select for organismic energy demands, humans interact with proportionately more of the environment than do other animals. In sum, humans modify the environment in significant ways other animals do not, and require a great deal of energy to do so. Yet that general rule, if it is one, does not ensure survival of the human species simply because it functions at high orders of hierarchical complexity. History has already demonstrated that very low order organisms cause massive losses of humans, that is, viruses and bacteria. Ultimately, then, it is not possible to say higher orders of hierarchical complexity are either favored by selection processes or "led to" teleologically by evolutionary processes. It is possible, though, to establish the ubiquitous role of hierarchical complexity in evolutionary processes.

DECENTERING AS EVOLUTIONARY BEHAVIORAL PATTERN

Stage theory has consistently indicated that individuals' perceptions of the world become increasingly decentered from themselves as they move from lower to higher stages (Commons and Goodheart, 1999). The same pattern of decentering occurs at different scales, depending on what is being observed. This is because it follows the orders of hierarchical complexity. For most individual humans, it transpires during part of the lifespan, until some point in adulthood. That point varies. In some adults, researchers have found a "major spurt in growth in their 40s and 50s" (Fischer and Pruyne 2003, p. 191). The same decentration process is evident in the span of sociocultural evolution over the known course of history traced by archeology and anthropology. Commons and Goodheart (1999, p. 9) showed that if decentration progresses to high stages of development, "mentalistic notions of causes of behavior such as free will are replaced by non-mentalistic or more behavioral notions of cause. Thus, cultural evolution recapitulates individual development." A recapitulated pattern indicates self-similarity. This pattern of increased decentration is evident both at an individual scale and a social scale, despite tens of thousands of years' difference in those scales. This indicates the fractal nature of the orders of hierarchical complexity. They are fractal because the behaviors at each order repeat at different scales of time, space, and task-performer (see "Fractal Transition Steps to Fractal Stages," this issue). The following broad sweep of hierarchical complexity's decentration progress throughout cultural evolution provides an account of behaviors.

> In societies, the process of decentering is analogous to the process that occurs in individuals, although it lasts much longer. As primitive societies evolve, the

> causes and explanations of behavior shift from a spirit or spirits within the self to processes occurring both within and beyond the self. This shift ultimately results in the abandonment of mentalistic explanations of reality in favor of materialistic explanations, of which modern behavior analysis constitutes an example. Primitive societies embrace the animistic worldview, seeing themselves and objects constituting the external environment as inhabited by souls, each endowed with different forms of will. Such explanations aim to account for the phenomenological experience of the self, me or I, or spirits, humors, demons, devils, bloods (e.g., bad blood, evil blood), and other entities in the world. More advanced societies move away from the self as god, embracing instead polytheistic or monotheistic religions that represent man as distinct from the divine, rather than being coextensive with the divine. Man becomes God's child, moving away from just the self. But the earth becomes God's world, the center of the universe. As the process of decentering progresses, the earth is displaced from the center and is now perceived to revolve around the sun. As the physical laws that order the universe are discovered, God retreats from the universe, becoming at the most a creator whose intervention in the world of his creation is hardly missed. At each stage of social development, society progresses not by discarding what came before, but by integrating it within a more hierarchically complex level of organization. . . . [Finally,] at the highest stages of social development, the phenomenological experience of the self is no longer considered as consubstantial with reality but rather as an effect of physical laws that can be observed to operate in other realms (Commons and Goodheart, 1999, pp. 9–10).

At the highest stages, the concept of a divine being, spirit, or god can be recognized as psychological projections of humans' own construction, used to explain aspects of the world that were not understandable without the concept at earlier stages. Thus, the hierarchical complexity view of evolution and history is an integrative account. Hierarchical complexity–based behavior analysis is a "science of psychology that is conducted at these highest stages of social development" (Commons and Goodheart, 1999, p. 10). Those who characterize it as materialistic are correct when those terms are understood in the non-Newtonian, non-mentalistic, and highly decentered terms just introduced.

HISTORICAL STAGES OF TECHNIQUES FOR ANALYZING EVENTS

The purpose of this final section is to indicate that the hierarchical complexity view of history is demonstrated across familiar domains and forms of behaviors. The cultural evolutionary societal periods with their chief political, religious, economic, and knowledge forms were enumerated in hierarchical complexity terms by Commons and Goodheart (1999). These each evidence the evolutionary decentering process sketched earlier. In a similar way, those authors traced key behavioral forms evidenced in behavioral science's evolutionary decentering, from the late foraging period of human societies to the post-postmodernity period. Such tracing of a field's evolution through stages of development can be performed for all fields of study and other endeavors, because all tasks are performed at some order of hierarchical complexity. To recognize such universals as these stages operating in diverse domains is a Metasystematic stage 12 task. It is a central one

to perform if one is to observe the orders of hierarchical complexity in evolution and history.

From the behavioral science account, we select the stages of development of *techniques for analyzing events.* We omit the transitions between their stages (but see Commons and Goodheart, 1999). Techniques for analyzing events are a perennial human activity in all domains in which a given stage of development is reached. They underlie decentering processes such as those recounted earlier. Expressed as they are in content-free, behavior analytic terms, this approach is meant to help one associate the stage-based characteristics of decentering with cultural behaviors everywhere, not just in the science that studies behaviors. The following periods from Commons and Goodheart (1999, pp. 20–21) are full of mixtures of stages; those listed here are illustrative of the highest in the periods' social/political domain.

Late Foraging Period—Concrete stage 8. Constructing chronologically ordered narrative representing multiple forms of stimuli and responses; counting of responses.

Early High Culture Period—Abstract stage 9. Comparing sizes, amounts, and qualities.

Empires, States Period—Formal stage 10. Rewarding behavior; eliciting responses within reflexes; considering the stimulus to be the cause of the responses.

Mid-modernity Period—Systematic stage 11. Establishing systems of relations between reinforcement contingencies and response rates; observing changes in response rates that result from a change in reinforcement contingencies.

Post-modernity Period—Metasystematic stage 12. Constructing multiple interpretations of the process of performance acquisition, modification, and maintenance within a single domain; generalizing models of the process of performance acquisition, modification, and maintenance to multiple domains.

Post-postmodernity Period—Paradigmatic stage 13. Studying the effects on behavior of occurrences of general sets of events in various changing contingencies; combing supersystems that explain acquisition and change, with steady-state performance across multiple measures such as single events, latencies, local and overall rates, and probabilities.

CONCLUSION

We demonstrated in this article some of the range of unidimensional zoom lenses made possible by the field of hierarchical complexity. We zoomed in to the individual scale to examine tasks of thinking about the concept of evolution. Then, we adjusted the zoom to the theoretical scale to show tasks of explaining evolutionary processes. An account of the hierarchical complexity view of evolution situated several hierarchical complexity arguments in relation to evolution. From that stance, we zoomed out to the scale of cultural evolution to provide a high-level overview of decentering processes that have marked different orders of hierarchical complexity often called societal periods. The final lens was applied to one kind of task that has permeated all stages of evolution over the course of recorded human

history, techniques for analyzing events. These, of course, include evolution and history.

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