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Behavioral Levels

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The contemporary model of development, relational developmental systems (Overton and Lerner 2014), is very much grounded in Darwinian evolution, but not the modern synthesis of this position. One can understand the important role that ideas of evolution play in behavioral development without adopting a reductionist, determinist, or otherwise innate perspective (Lerner and Overton 2013; Lickliter 2016). Behavior develops and changes, a result of a myriad of influences (endogenous and exogenous) almost from the moment of conception and, based on current understanding of epigenetics (e.g., Moore 2015, 2016), perhaps before as well. Evolution, of course, is itself about change, and therein lies the crucial relationship between biology and psychology.

The fundamental law of Darwinian evolution is that change results from *natural selection*. But, as with all theories in science, Darwinian evolution has itself been subject to change and modernization. Accordingly, I follow Ho and Saunders in understanding *increasing complexity* (i.e., anagenesis) to be a second law of evolution after natural selection (Saunders and Ho 1976, 1981). Others who have adopted this line of thinking (e.g., Stebbins 1969; Smith and Szathmáry 1995) did so from the perspective of the idea that there is a hierarchy of levels of increasing complexity and organization with evolution. Indeed, this idea can be considered " a central phenomenon of life" (Vrba and Eldredge 1984, p. 146). That this principle is extremely important in scientific understanding was recognized early by Pringle (1951) who noted that "The characteristic of living systems which distinguishes them most clearly from the non-living is their property of progressing by the process which is called evolution from less to more complex states of organization" (p. 175).

This hierarchical principle applies as well to the sciences which can be divided into areas of study based on qualitative changes in complexity of organization: physics and chemistry address lower levels of complexity; biology, psychology, and sociology address higher levels of complexity. This idea appears to have originated with Auguste Comte in the late 1800s (see Boorstein 1998, p. 223) and was subsequently developed in the twentieth century by others such as Novikoff (1945) and Feibleman (1954) (Greenberg and Partridge 2010; Greenberg and Tobach 1984), conceptualized as the "concept of integrative levels." Aronson (1984) described this idea as a crucial organizing principle in science which is "... a view of the universe as a family of hierarchies in which natural phenomena exist in levels of increasing organization and complexity. Associated with this concept is the important corollary

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that these successions of levels are the products of evolution. Herein lies the parallel with anagenesis" (p. 66).

In their important book, Michel and Moore (1995) noted that T. C. Schneirla, among the preeminent comparative psychologists of the twentieth century, applied this thinking to behavior invoking the idea of phyletic levels. Michel and Moore note that by advancing "the idea that the study of evolution could be informed by developmental analysis" (p. 120) Schneirla emphasized that both biology and psychology are developmental sciences. The historical record is clear that as evolution has continued it has resulted in increasingly more complex forms of animal life. In the context of this discussion it is evident that, with few exceptions, more recently evolved forms are more complex in their biology and their behavior than are earlier evolved forms. Schneirla pointed out that we can "begin to understand the differences between species by noting gross differences in behavioral complexity" (Michel and Moore 1995, p. 121) in a hierarchical relationship reflecting a strong correlation between both biological and psychological complexity.

Applying this idea to behavior, Tobach and Schneirla (1968) proposed an anagenetic, hierarchical ranking of behavioral levels across species, based loosely on the fact of increasing neural complexity with evolutionary advance. The behavioral levels are separated into two groups, one at which biological factors dominate behavior and one at which psychological and social principles become important. The levels they identified are: *Taxis*, at which behavior is under immediate stimulus control, an example of which is a moth flying toward a light source; *Biotaxis*, a higher level at which behavior is influenced not only by the immediate presence of a stimulus but also by the presence of biochemical sequelae from other organisms such as pheromones; and *Biosocial*, the level at which the social interaction of groups of animals plays an important role in organizing and regulating behavior. In Schneirla's analysis of army ant behavior, he saw their cyclic activity to be a result of reciprocal social stimulation provided by the enormous number of individuals in an ant colony. That cyclic activity is absent in single ants and is seen only when ants are together in large numbers; *Psychotaxis*: Psychology becomes important at this phyletic level in the form of mediation by past experience. Rosenblatt and Schneirla (1962) demonstrated with cats that the relationship between infant and mother begins with biotactic orientation by the kitten to its mother by means of tactile and olfactory stimuli. Subsequently, higher-order processes (e.g., learning and reinforcement) enter in at later stages of that relationship; *Psychosocial*: at this highest level behavioral organization is regulated by complex social bonds and social interactions characteristic of advanced vertebrates. Among primates, for example, lasting social bonds result from initial complex biosocial and biotactic interactions between an infant and a mother such as those involved in rocking, providing of contact comfort, and nursing.

Tobach and Schneirla (1968) ended their analysis with the description of the psychosocial level. There is, however, merit in developing the system somewhat further to differentiate among phyletic levels of primates and their corresponding communication behaviors. Whereas the behavior of all primates falls into the pychosocial level, at least with respect to communication there are less and more complex forms. All primates communicate, but a few individuals of some species have developed complex communication skills, bordering on true language (Savage-Rumbaugh et al. 1993). Accordingly, it seems appropriate to further subdivide the psychosocial level into three separate behavioral sub-groupings (Psychosocial I, II, and III; Greenberg and Haraway 2002), distinguished by the nature of communication complexity: a communication only, nonlanguage level (e.g., vervet monkeys); a proto-language level (e. g., chimpanzees and bonobos); and a true language level (only *H. sapiens*). Each of these behavioral levels is demarcated by the evolutionary appearance of species whose behavioral repertoires are increasingly more plastic and complex (Lerner 1984) as are their nervous systems. This ordering of these levels is similar to that of traditional phylogenetic taxonomies.

The utility of the application of this behavioral taxonomy can be seen in the way Greenberg and

Behavioral Levels, Table 1 Levels of behavioral complexity displayed by major animal groups in feeding behavior

Major groups	Higher levels of complexity illustrated
Protozoa	Taxic
Cnidaria	Taxic
Cnidaria	Biotaxic, biosocial
Echinodermata	Biotaxic, biosocial
Platyhelmenthes	Biotaxic, psychotaxic
Molusca	Biosocial, psychotaxic
Arthropoda	Biosocial, psychotaxic
Osteichthyes	Biosocial, psychotaxic
Amphibia	Biosocial, psychotaxic
Reptilia	Biosocial, psychotaxic
Aves	Psychotaxic, psychosocial
Mammalia	Psychotaxic, psychosocial

Haraway (2002) demonstrated its use for feeding behavior and its complexity across phyla and species. As animals became more complex with evolutionary advance, their nervous systems and feeding behavior became increasingly diverse and flexible. Table 1 lists major animal groups and shows at which behavioral (phyletic) levels their feeding behavior may be organized.

This notion is directed at the classification of behavior. Note that for most groups feeding behavior is organized at more than one level and that individual species can function behaviorally at more than one level (for example, at different stages in its development). Each animal then should be classified at its highest level of behavioral complexity in respect to a behavior, with the idea that a higher classification subsumes the levels below it. In Protozoa, such as the ameba, feeding is regulated solely by the presence of appropriate chemicals at appropriate intensities; they are thus organized taxically for this behavior. Among the Cnidaria, such as Hydra, feeding is mostly a taxic process, although the ability of these animals to distinguish among living or recently living foodstuffs for prey suggests some biotaxic organization. Feeding by mollusks shows even higher organizational processes at work, allowing learning to become an influence of their feeding behavior. Among the vertebrates, feeding complexity, the influence of conspecifics, and many components of learning (e.g., the remarkable caching ability of some birds) show their feeding behaviors to be organized at the highest levels. This organizational system was applied by Greenberg and Haraway (2002) to a full range of behaviors further attesting to its utility and is shown in Table 1.

The heuristic value of Schneirla's use of the levels concept in this way can be seen in replies to criticisms that have been leveled against it (Tobach and Greenberg 1984). Against hereditarianism, the concept poses the question about how genes might function at different levels; there is no special value placed on any level, succeeding levels integrate preceding ones, and the formulation of a question determines the appropriate level of inquiry; the concept does not imply anything about the "proper" research to be done as investigations are needed at all levels; the levels concept provides for the generation of critical hypotheses, especially regarding developmental issues; and finally, "the levels concept . . . belongs to the province of the science historian" (Tobach and Greenberg 1984, p. 6) which is reflected in the statements of Pringle and Aronson cited earlier in this entry.

Cross-References

- ▶ Approach/Withdrawal
- ▶ Comparative Psychology
- ▶ Development of Behavior
- ▶ Epigenesis
- ▶ Ethel Tobach
- ▶ Evolution
- ▶ Herditability of Behavior
- ▶ Language Research: Great Apes
- ▶ Primate Communication
- ▶ Protolanguage
- ▶ Psychosocial, Psychotaxis

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