

## Can Knowledge of Evolutionary Biology and Ecology Inform Evaluation?

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Can applying concepts from evolutionary biology and ecology lead to actionable evaluation questions that would not otherwise reveal themselves? My plan is to pursue this inquiry for a while and see where (if anywhere) it leads. “Actionable” matters to me because I’m not interested in exotic concepts that capture evaluators’ attention but do not lead to implementable decisions about models, methodologies, and metrics. This inquiry follows from my [ten-part series on applying complex behavior in evaluation](#). Evolutionary and ecological dynamics show up frequently in the complexity literature, and now I’m focusing on that narrow slice of the field. I’ll start by presenting a case, and then working through the implications of taking an evolutionary biological and ecological perspective.

- Case: Early childhood parent support
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  - Evaluation design
- Some useful concepts from evolutionary biology and ecology
  - Population
  - Coevolution
  - Birth/death rates
  - Selection pressure
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- What would the evaluation look like if its design were informed by knowledge of evolutionary biology and ecology?
  - Populations, and birth/death rates
  - Coevolution and population
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- Do we gain anything from applying an evolutionary lens?
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## The Case Example: Early Childhood Parent Support

This example is adapted from a more elaborate example that I use in my complexity workshops. (For the whole case see page 61 of my [workshop slides](#).)

### Design of the New Parent Support Program

The program is designed to assist new parents with infants. It has two components: 1) classes for mothers and fathers, and 2) in-home coaching. What makes this program different from other similar programs is its deliberate effort to base all content on the best social science research available.

**Classes:** The classes are provided at local civic organizations who volunteer to host the program. There is no requirement that mothers and fathers both attend, but dual attendance is encouraged. The classes are offered to anyone who wants to sign up. The classes meet once per week for a three-month period, on a recurring schedule. People who wish can attend more than one series.

**1:1 Coaching:** This activity consists of in-home visits by a social worker who is an expert in parent-child interaction. Telephone support is also provided. The social worker is also encouraged to provide referrals for other types of services.

**Classes + Coaching:** There is a strong belief that classes plus coaching will be uniquely beneficial. There is no requirement that program participants avail themselves of both services, but it is encouraged.

### Evaluation

**Classes:** Questionnaires are used at the middle and end of the class series to evaluate the material, instructors, etc. The usual stuff. Also, participants are interviewed about “critical incidents”, i.e. circumstances with their children where they felt that participating in the classes made a real difference. In cases where both mothers and fathers are taking classes, some questions are added about whether the joint attendance made a difference. These interviews begin at about the middle of the three months and extend for the duration of the five-year evaluation schedule, at six-month intervals. In order to minimize respondent burden, only a sample of participants is contacted at each interview period. Important outcomes include the number of people reached by the classes and whether the classes affected how the parents interacted with their children.

**1:1 Coaching:** Participation is randomly assigned to half the class participants. The control group is given coaching assistance only through telephone support. The same data collection procedures that are used for classes are used here too, with the exception that observations made during home visits are included in the evaluation data.

**Scale-up:** The evaluators recognize that in order to understand implementation and effectiveness in different settings, a systems-based approach, informed by a realist evaluation sensibility, is called for. In that spirit, interviews, and observations pay careful attention to topics such as: 1) differences in the structure and culture of the communities where the program is implemented, 2) differences in the population of program participants, 3) beliefs and priorities of those who provide the services, and 4) other services that are available in each of the communities.

**Methodology – Comparison Groups, Time Series, Interviews and Case Studies:** Four elements comprise the evaluation design. 1) The test programs are implemented in three different communities. In each, the programs offered are subject to a thorough case-study analysis. In addition, interviews and surveys

are conducted in order to understand the nature of the community and other related services that are provided. 2) Two similar communities are chosen as non-treatment controls. These are also subject to survey and case study analysis of the parent-support infrastructure. 3) Surveys take place in another 20 similar communities. The surveys record whatever outcome data can be gleaned from a few simple questions to service recipients. The surveys also ask about the general state of civil society and social programs that are active in the community. 4) To augment the 20-community analysis, public records and social media data are collected on the same topics that are covered in the surveys. The evaluation lasts for five years.

### Some useful concepts from evolutionary biology and ecology

At this point in my thinking, I see five concepts drawn from evolutionary biology and ecology that might lead to evaluation that our traditional approaches might not generate.

- Population
- Coevolution
- Birth/death rates
- Selection pressure
- Species and species variation

On their face, all these concepts seem to be based on biological considerations. However, each of them also has characteristics that are applicable to social constructs.

**Populations, not individual programs:** The fate of individual organisms is not of concern in evolutionary biology and ecology. In those fields what happens to individuals only matters if it affects the viability of a group of organisms, i.e. a species. If constructs drawn from evolutionary biology and ecology are to be relevant in evaluation, the evaluation questions must focus on types of programs, not on individual instances of those programs. As an example, the question would not be whether a particular STEM program in a particular middle school succeeded in motivating kids to study science. The question would be whether implementing STEM programs in middle schools is a good way to increase interest in science.

**Coevolution:** Coevolution is a "... process of [reciprocal](#) evolutionary change that occurs between pairs of [species](#) or among groups of species as they interact with one another. The activity of each species that participates in the interaction applies [selection](#) pressure to the others." The analogue in evaluation would be a scenario in which the outcome of one program affects the viability of another. To build on the previous example, those STEM programs may involve after school activity, and thus affect childcare programs that are also operating in those middle schools. Or as a second example, devoting resources to STEM may remove after school time for kids to get involved in other kinds of extracurricular activities. (I have an elaborate example of this dynamic in a [blog post](#) on what happens when a program focuses on pursuing highly correlated outcomes.)

**Birth and death rates:** While the birth and death of individual organisms is not a major concern, birth and death rates within a species do matter because those rates have consequences for species survival. In the example of the new parent support program, the evaluation calls for a survey of social service programs in twenty communities over a five-year period. Knowing the rate at which new parent support programs come into existence and cease to function might provide valuable insight about the

potential for sustainability of the innovative programs in the three communities where those programs were tested.

**Selection pressure:** Selection pressure refers to [“The pressure exerted by the environment, through natural selection, on evolution.”](#) A good example of how this idea is applied on a social scale is “evolutionary epistemology” as a way of explaining the growth of knowledge. This view posits the generation of new scientific ideas and theories not only in terms of their own merits, but also with respect to the knowledge context in which they reside. One might even think of the new idea as a “mutation” in a body of thought that may thrive depending on the conditions of its environment. Thus, it’s not much of a stretch to apply “selection pressure” to human constructs such as goals, beliefs as to the best ways to achieve those goals, desired outcomes. and similar human mechanisms that are central to planning and evaluation.

**Species and variation within species:** Some perspectives on the definition of a “species” are distinctly biological, having to do with sexual reproduction and genetic makeup. Other perspectives on the definition of a “species” are more relevant for the world we evaluators inhabit. These definitions include morphology (form and structure), an organism’s behavior, and the ecological niche the organism inhabits. Even within these categories, evolutionary biology makes ample room for differences among members of the same species, and fuzzy boundaries among related species. All of these are familiar concepts to any planner or evaluator who tries to define what a program is and where it should be implemented.

### **What would the evaluation look like if its design were informed by knowledge of evolutionary biology and ecology?**

The title of this section poses the crucial question. Would the evaluation look different? I’ll answer this question first, and then pay some attention to the question of whether it would look different enough to go to the trouble of drawing on strange ideas from a field that is distant from our own. I’ll also show how doing the evaluation with respect to evolutionary biology and ecology would not require any methodologies other than the familiar ones listed above in the section: “Methodology – Comparison Groups, Time Series, Interviews and Case Studies”.

That we can rely on our familiar methodologies is not to say that evolutionary biology and ecology have no unique methodologies that could be useful to us. Those methodologies most certainly exist. I’ll discuss these methodologies at the end of this document. But for now, I want to make the point that concepts from evolutionary biology and ecology can be valuable even without resorting to those fields’ specialized methodologies.

**Populations, and birth/death rates:** An evolutionary perspective on evaluating the new parent support program would emphasize population size, and within size, birth and death rates. “Population size” refers to the number of similar programs. Birth and death rates refer to the churn within the overall population size. Even though the surveys would provide the data necessary to consider population and birth/death rates, I don’t think that such an analysis would manifest itself with traditional evaluation thinking. That kind of analysis, however, would be second nature to people thinking in terms of evolutionary biology and ecology.

To see the value of this kind of thinking, imagine that the case study data showed that in two of the three experimental communities, two programs showed a decrease in the number of people participating in the early childhood programs, and one program ceased to operate. How might an evaluation team explain these findings? No doubt the evaluators would delve into all the interview and observational data, propose possible explanations, and then question their conclusions. The exercise would be a multiple-comparative case study design that employed a grounded theory analytical perspective.

To see how the concepts of population and birth/death rate might enrich this analysis, imagine two different scenarios that might be revealed by the survey data. In scenario number one, survey data showed that the total number of similar programs increased dramatically, and that the programs that came into existence maintained their operations. We have a high birth rate and a low death rate, which combine to make an overall population increase. In the second scenario, survey data showed that few new programs came into existence, and many that did, closed after a short period of time. We have a high death rate combined with a low birth rate that combine to make an overall population decrease. Table 1 depicts these two scenarios.

Table 1: Two new parent support program population scenarios for the same case study findings

		Birth Rate	
		High	Low
Death Rate	High		Scenario 2 Decrease population
	Low	Scenario 1 Increase population	

If I had this data in hand, I might entertain the notion that the case study data did not fully explain the success of the new parent support programs. In scenario number one, I might consider that the explanation for success lay in environmental conditions that favored new parent support programs. In scenario number two, I'd look for an explanation as to why the programs in the experimental communities bucked the general trend for new parent support programs to fail. These are not insights that would occur to me if I only had case study data on three treatment and two non-treatment communities.

**Coevolution and new parent support program population:** Imagine that the case study data showed that in all three experimental communities:

- the new parent support programs continued to operate for the entire five-year program schedule, and that
- the number of programs aimed at preparing kids for first grade, increased.

Case study data also showed that in the two control communities:

- there were no new parent support programs, and
- there was no noteworthy activity with respect to school-preparation programs.

This pattern of findings might raise suspicions that a relationship existed between new parent support and school readiness services. But if I were doing the evaluation, the possibility of such a relationship would not seem strong enough to pursue. In any event, what could be gleaned about this kind of complicated relationship from five cases?

But now imagine looking at the survey data and finding a correlation between expansion of new parent support programs and an expansion of school readiness programs. A summary of the case study and survey findings appears in Table 2.

That correlation would get me to take the possibility of a relationship seriously. It would not demonstrate a mutual relationship, but it would get me thinking about it hard enough to take a deep dive into the case study

	Experimental Communities	Control Communities	Survey of 20 communities
1 Parent support programs operating?	Yes	No	
2 School preparation programs expand?	Yes	No	
3 Correlation between implementing new parent and school readiness programs?			Yes

data. Is there overlapping leadership or a joint community of interest driving both types of programs? Do successful new parent support programs motivate parents to ask for school readiness services for their children? Do successful school readiness programs motivate a community to expand, or change their new parent support efforts? I'd still only be working with five cases, and I'd still be nervous about generalizing from those meager findings. Still, I'd begin the investigation with a firm belief that there was a correlation between the appearance of new parent support programs and school readiness programs. That would be enough to give me confidence to stretch the case study data.

**Selection pressure:** Imagine the set of findings shown in Table 3. A reasonable interpretation would be that the conditions across the environment in which all the communities reside are favorable for the expansion of new programs (row 1), but that if a new parent support program is operating, school readiness programs will constitute the bulk of the increase.

	Survey of 20 communities
1 Increase in the number of “other” programs?	Yes
2 Correlation between implementing new parent and school readiness programs?	Yes
3 Additional patterns between types of programs?	No

What might explain this conclusion? Drawing from my work on complexity, I'd argue that the environment in which all the communities reside is favorable for the implementation of new programs, hence the finding in row 1.

I'd also argue that because environments are complex systems, complete with sensitive dependence on conditions and nonlinear behavior, it is possible to determine only that there is a high probability that a new species will appear, but it is impossible to predict the specific characteristics of that new species (row 3).

*Except* when a community already has a new parent support program. Then the behavior of the complex environmental system shifts to bias new species appearance in favor of school readiness programs (row2). That is selection pressure.

**Species and species variation:** Imagine findings that showed that over the five-year test period, the new parent support programs retained their essential nature and improved new parent behavior, but diverged in various ways. Not all programs made these changes. Also, even when different programs adopted the same change, they did not do so in precisely the same way. Observed changes included: 1) curriculum for classes, 2) coaching methods, 3) use of phone and collaboration technology to augment in-home visits, 4) combining and separating mothers and fathers during class sessions, and 5) assistance with dealing with other services, e.g. welfare, health, and job training. Thus, at the end of five years the findings show that: 1) all the programs still focused on new parent support, 2) they all looked different, and 3) they were all effective with respect to new parent support outcomes. In evolutionary jargon, the species remained recognizable in their essential nature, but diverged from each other with respect to many characteristics.

### **Do we gain anything from applying an evolutionary lens?**

Much of what I said above is recognizable in well-known evaluation approaches. There is a heavy emphasis on multiple methodologies, with a hefty reliance on combining qualitative and quantitative data. System thinking is present, with its emphasis on boundaries and mutual influences among parts of a system. Fidelity to known effective services shows up in the findings that all programs retain their essential services, and all continue to produce the desired outcomes. A developmental evaluation sensibility is present in observations about how the programs change over time.

So why bother with alien concepts from other fields? After all, technical terms, frameworks, theories, and methodologies in one discipline are often reflected in the terms, frameworks, theories, and methodologies of other disciplines. It's easy for someone in one discipline to listen to someone in another discipline and think: "The words are different, but I could have done that. Why not stick to what I know I can do well?"

So why should evaluators take a step into unfamiliar, and perhaps uncomfortable territory? One answer is that they should not, and usually, that would be a correct conclusion. But for two considerations: 1) paradigmatic constructs, and 2) methodology.

Constructs: Disciplines have unique ways of identifying topics to research, developing models, generating hypotheses, choosing methodologies, defining data needs, specifying acceptable answers, and interpreting data. It's not a matter of choosing any one of these concepts. It's a matter of the thought process that derives from thinking about all of them. One might even view this in terms of emergence. The system is made up of many discrete parts, e.g. the nature of an acceptable answer and favored methodologies. All these parts are networked because decisions about each have implications for the others. Under these conditions, the analytical mindset that emerges is unique.

Do a thought experiment. Would applying an evolutionary biology lens to an evaluation challenge lead to an evaluation that would be significantly different from an evaluation designed only with our traditional approaches? Because of the emergent analytical mindset, often the answer would be "yes", the evaluation would be different.

Methodology: Disciplines employ different methodologies, and there are times when one discipline would do well to import a methodology from another. A major theme in research in evolutionary biology and ecology deals with rates of change and parameter values at different points in time. Some examples: predator/prey relationships, species extinction and birth, adaptability to new environmental

circumstances, and appearance of mutations. In all these cases, critical research questions include: How many of such and such are there? How quickly are the numbers of such and such changing? What is the relationship between changes in group X and changes in group Y? Evolutionary biology and ecology have developed theories, backed by mathematical formulations, to articulate relevant hypotheses about these kinds of changes. These approaches have been borrowed to great effect by social scientists. As an example, theories of species birth and extinction have been applied to types of organizations ([Organizational Ecology](#) Hannan and Freeman).

In what I have written above, I tried to make a convincing case that even if the methodological technicalities are avoided, concepts drawn from evolutionary biology and ecology can be powerful additions to the way in which evaluators make decisions about models, metrics, and methodologies. Nevertheless, I do not want to argue that technical formulations of theories in evolutionary biology and ecology have no place in evaluation. When we shift our focus from individual programs to groups and types of programs that are operating in the same ecological space, the technical methods are useful. Moreover, the availability of those methods should prompt us to expand our evaluation questioning from programs to populations of programs. If we did that, we would be doing our customers a service.

***Respect data. Trust judgment.***