

Social sophistry: logos and mythos in the forms of cooperation

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In Plato's cave, humans chained to a wall see the world only as flickering shadows of statues, removed by several degrees from the 'real' world of ideas and forms. As the cave-dwellers communicate thoughts about the statues, their words add yet another layer of removal and distance, here between each others' perception and thought-pictures. Over ten years ago, I asked a number of the philosopher queens and kings of social insect biology how they conceived and applied the term 'reproductive division of labor', the core of the traditional definition of eusociality. From each person I received a different answer. I reckoned then that social terminology systems required an attempt at meeting of minds, to avoid implicit confusion and to foster progress in recognizing social convergences. Down the hall I went to Paul Sherman and his erudite mind. We compared our flickering shadows, decided to write a paper together, and started — but then realized that we viewed the wall quite differently, and two contrasting papers were the ultimate result.

The conceptual impact of the papers by Sherman *et al.* (1995), Crespi and Yanega (1995), and later Costa and Fitzgerald (1996), Wcislo (1997), and Crespi and Choe (1997) may be assessed in several ways. First, the papers have been cited 80, 45 and 22 times respectively (for the first three papers, Web of Science), which sug-

gests that workers are aware of the importance of cave-shadows in defining societies. Indeed, recent authors are usually careful to explain their use of social terms (e.g., Burda *et al.* 2000), probably more careful and explicit now than pre-1995. I see this as progress — at least we know that we are in a cave like Plato's.

Second, tabulation of how often various social terms were used before *vs.* after 1995 (Costa & Fitzgerald 2005) can demonstrate any trends, though the connections between word use and application of concepts is difficult to judge.

Third, we can seek to assess conceptual impact by determining if any of the specific suggestions of the authors have been implemented. For example, Crespi and Yanega (1995) proposed that some 'traditionally eusocial' ants, bees, and termites should be considered as cooperative breeders. Search for the combined terms 'insects' and 'cooperative breeding' on BIOSIS for 1985 through 1994 yielded 12 citations, with only one on social insects (ants). By contrast, 1996 to 2005 produced 27 hits, including two papers on ants, two on termites, five on wasps, and three on bees. A search for 'eusociality continuum' over this period gave only one empirical paper, on Zambian mole rats. I take this as suggestive evidence that some workers have adopted at least one central idea of Crespi and Yanega (1995), that insects can be cooperative

breeders, and that the eusociality continuum is proving difficult to apply in practice.

Of course, the science of social insect biology exists not just in the literature, our equivalent of the Greek *logos*, linear and logical communication meant to convey facts. Perhaps more importantly, it exists in our minds, hodge-podges of scientific lifetimes of mentors, colleagues, and students, thousands of papers and talks, and communing with our own favorite social creatures. To reach and change minds the Greeks used *mythos* — word-pictures, stories, analogies and metaphors that convey deep truths and values. Here, I have used Plato's cave as *mythos* for our thoughts concerning the forms of sociality.

So are there 'real' forms of sociality behind us, casting shadows? I like to think so — at least 'real' in the sense of unambiguous convergence on small suites of core social traits, as opposed to Wcisloian (1997) truths beyond history, or the heuristic phenomenology of Nonacs (2001). A large set of species is unique in having evolved reduced reproduction by some individuals, in association with a trade-off between helping and offspring production. In some, 'eusocial' forms, the tradeoff involves two permanently-distinct types of individual, and this permanence results in two independently-evolving phenotypic systems. In other, 'cooperatively-breeding' forms, the difference between 'breeders' and 'helpers' is not permanent — individuals are 'totipotent' and can switch roles. Transitions from cooperative breeding to eusociality probably occur very rapidly (Crespi 2004), such that transitional forms will seldom blur this distinction. Finally, in 'communal' forms, there is only one type of individual, who both breeds and engages in helping — and this social system appears never to evolve into cooperative breeding or eusociality, or vice versa (Crespi 1996).

All three social systems described above include vertebrates and invertebrates, and in all of them colonies, populations and species may vary in social sophistication, behavioral repertoire, complexity, skew, degree of reciprocal communication, or whatever. Convergences may be sought for any social traits, at any levels — wherever one finds interest. But in my view the tripartate scheme above is the most fundamental division, which is ignored only with peril,

because these three social systems are *different*.

Costa and Fitzgerald (2005) argue that the term eusociality should apply only to traditional 'advanced' eusocial forms among Hymenoptera, Isoptera, and naked mole rats, because only these species exhibit reproductive division of labor plus complex social repertoires, cooperative foraging, and food-sharing. All other species should simply be referred to as 'social'. Thus, instead of using one explicitly-applied core convergent trait (reproductive division of labor, be it permanent, temporary or absent) as the foundation of their terminology system, they use what I consider to be several arbitrarily-chosen traits (the latter three criteria), and they retain the very vagueness in the term 'reproductive division of labor' that led us into this flickering cave ten years ago. Their viewpoint will not, in my view, fuel the hunt for broad convergences. Indeed, I posit that it has been only via the conceptual application of the term eusocial to some shrimp, beetles, thrips, and aphids that we came to recognize the presence of two clear modes of eusocial forms, the factory-fortress inhabitants (including some termites and naked mole rats) and the central-place foragers (Crespi 1994, Strassmann & Queller 1998), that has each evolved convergently. Rather than seeing such a distinction as 'potentially misleading' (Costa and Fitzgerald 2005), I perceive it as providing important new insights into how ecological factors can generate reproductive division of labor. Would having called many of these taxa simply 'social', lumping them with marmosets, some caterpillars, and some spiders, have led to this inference?

Finally, most readers will have noticed that the contrasting visions of social terminology described in these papers reflect the taxa and theories of their authors: Sherman and Reeve (1995) working with 'eusocial' mole rats and skew theory for the continuum, Costa and Fitzgerald (1996, 2005) seeking recognition for the social sophistication of caterpillars, and Crespi (Crespi and Yanega 1995) elevating the lowly thrips to the altruistic alter of ants, bees and termites. Whether or not the memes of these authors are self-serving, the usefulness of their views in recognizing convergence, posing new questions, and structuring the minds of the next generation of students is the ultimate question. The controversy over social terminology has, I

think, served at least one fundamentally-important purpose: showing us that to reach the next truths in the study of social evolution, we should engage in continued shadow-dispelling discourse on the many meanings of being social.

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