I am an anti-adaptationist, at least about the mind. I am also someone who has long been convinced by what many take to be the damning criticisms of evolutionary psychology (henceforth, 'EP')—the view that (to put it generally), we must and can only understand the organization of the mind in evolutionary terms. So it was with some trepidation that I agreed to review Barrett's book, and it was with some surprise and delight that I found it so insightful, erudite, and interesting. There is a lot of wonderful material in this book, even for those who don't agree with EP as an approach to the mind. And that's good because, despite the many agreements I have with parts of the book, I remain as steadfastly opposed to EP as I was before. I'll begin by saying what I take the valuable contributions to be, before explaining why I am still unmoved.

The broad project of the book is to upd:ate EP in such a way as to unwed it from a range of conceptual associations that have grown up around it. Barrett is against the view that "modular vs. non-modular, lower-level vs. higher-level, unconscious vs. conscious, automatic v. controlled, innate vs. learned, specialized vs. unspecialized, and evolved vs. something else" (p. 266) are all the *same* distinction, at least in terms of how they carve up the mind. Rejecting this view allows Barrett to argue that EP is compatible with big chunks of current evolutionary theory and cognitive science that are standardly taken as problems for, if not outright falsifications of, the program. Here, in no particular order, are some of the important conceptual moves made by Barrett. He convincingly claims that:

- EP is not committed to dual-systems views of the mind.
- "Preformationist" views of innate mental traits are hopeless, and that an appropriate view of EP must take into account both evolution and development.
- The context-sensitivity, plasticity, flexibility, and interactivity of cognitive mechanisms is incompatible neither with construing them as functionally specified nor as modular. Indeed, we should expect most computing mechanisms to exhibit both specialization and certain types of flexibility and context sensitivity.
- Probabilistic and inductive processes are vital to both evolution and cognition, and should be an important part of EP's story.
- Learning and cultural evolution are, in part, dependent on the "enabling" constraints present in the mechanisms that pre-date those processes.

Barrett argues that evolution is importantly *open*. It shapes probabilities, implements beneficial constraints, and grows systems incrementally rather than by incorporating entirely new, dedicated mechanisms for specific outcomes. This openness allows for EP to incorporate the above perspectives whole, without denying a role for evolution in cognitive explanation. On all these points, I am largely agreed (although I'd quibble with many specifics, for instance his way of "saving" modularity; see Burnston & Cohen, in Zeimbekis & Raftopoulos, 2015), and Barrett guides the reader through them with a steady hand.

So, with all this agreement, what's the worry? Unfortunately, these advances, impressive though they are, entirely fail to address what I take to be the biggest problem for EP—the commitment of the view to adaptationist accounts of mental traits.

There are at least three main lines of criticism that have been leveled against EP. The first is biological—EP is supposed to be committed to a type of degree of adaptationism that is unlikely to hold. The second is cognitive-scientific—EP is supposed to be committed to views of cognition/functional specialization that are false. The third is, I suppose, primarily philosophical—EP is supposed to offer explanations that fail to meet the standards for good explanations. One can find variants of these critiques throughout the literature on EP (including in the book length critiques by Fodor, Buller, and Richardson). My primary objection is a version of the third. With regards to the first two, my main problem with the book is that it can be frustratingly myopic when considering

alternative theoretical perspectives. On the biological side: there is a significant debate in biology about to what extent phenotypic traits are due to adaptation/natural selection, versus those that are due to drift—random genetic, developmental, and environmental factors or events that, according to some, are capable of pushing traits towards fixation despite a lack of influence from selection (for discussion and elaboration of this view, see Kimura, 1979; Beatty, 1984; Millstein, 2002). Drift is only mentioned a couple of times in the book, and only obliquely: Barrett is willing to countenance drift as helping to produce genetic variation (p. 301) or helping to set up the environmental (including social) circumstances in which adaptation can then occur (p. 220), but drift is never considered as a serious alternative for how mental traits might arise.

On the cognitive science side, Barrett favors a model on which cognitive processes are hierarchical and sequential, saying that it is "generally agreed that processing in most domains is hierarchical, occurring in stages" (p. 107). On these kinds of views, cognition works via a large series of input-output devices (which Barrett sometimes calls "parsers"), each operating on the information passed to it by previous specialized mechanisms. This fits in well with his model of additive evolution, on which new functional parts are evolved to interact with what has come before in a way that is fitness-increasing (for the relationship between hierarchical mechanisms and additive evolution, see pp. 300–308). However, it is simply not "generally agreed" that *all* processing is hierarchical. I will discuss one case, visual processing, in detail below. Here are a few other examples. Barrett cites Treisman's model of attention, on which attention serves to highlight already-processed perceptual information. However, more current models suggest, as Mole (2015, in Zeimbekis & Raftopoulos, 2015) nicely summarizes, that "processes responsible for the allocation of attention [are] inextricable from the processes that are responsible for the perception of the things to which we attend" (p. 225). On these models, attention works concurrently with perception, by biasing competition amongst perceptual processes (see Desimone,1998; Duncan, 1998; Reynolds & Desimone, 1998.) In terms of language processing, for instance in reading a sentence, Barrett seems to favor a view on which individual pheonomic structures are parsed and then recombined, such that there is "a chain of processing necessary to build (extract, infer) … meaning from patterns of ink on a page" (p. 283). There is a long history, however, of "interactive" architectures for linguistic processing (see Samuel, 1997), inspired by phenomena such as phoneme restoration, on which phonemic representations are not universally represented prior to lexical ones. Moreover, Port (2007) has argued that lexical representations in memory are stored primarily as communicatively relevant chunks (phrases, etc.) rather than as discrete phonemes. Spivey (2007, ch. 7) argues that semantic context-effects on word recognition are incompatible with stage-based accounts of lexical processing.

One area in which the hierarchical view may be on better footing is in action-understanding, in which Barrett suggests that we perceive and understand actions by distinctly parsing their elements and subgoals and then combining those subgoals to represent the entire action. There is a huge amount of phenomenological and social evidence that we do in fact do this to some extent—we do tend to *explain* actions in this particular way, although I am skeptical of the claim that action perception works according to these principles (see below). However, it is worth noting that these considerations are often taken to support a hierarchical view of the motor systems that plan and produce actions, and this view has been heavily challenged. Uithol et al. (2012) argue that action-stages are abstractions imposed from outside by our social practices for explaining actions, and that they do not match the neural data (cf. Uithol et al., 2014). Moreover, Graziano (2002) convincingly shows that, in the motor systems of the brain, behavior is represented as concerted suites of motor action and not as isolated discrete elements. He further expands this into a general critique of hierarchical approaches to neural organization (Graziano & Aflalo, 2007).

Of course, this is not to prejudge the outcome of these debates. But the fact is that there *are* debates

about the cognitive structure underlying each of these processes. While at times Barrett does attempt more sophisticated *versions* of the hierarchical picture (e.g., ones that combine parallel and serial processing, or ones that employ central "bulletin boards" with widely available information; see pp. 292-294), someone who finds the foregoing perspectives compelling (as I do) might be inclined to question the fundamental view of cognition that Barrett assumes from the outset.

I state these worries because they will come up again. As mentioned, however, my main criticism is about the explanatory role that is supposed to be played by adaptationism on Barrett's account. The standard explanatory critiques of EP are that adaptationist hypotheses fail to live up to appropriate standards of evidential support and testability (Richardson, 2007), and/or that they rule out genuine alternatives without sufficient argument (Lloyd, 1999). While I think these criticisms are relevant (see above), my version is slightly different, and is inspired more by another common type of claim in the book. There are a number of places in which Barrett does cite competing claims about cognitive architecture—Gauthier v. Kanwisher on face perception, debates about whether dynamical systems approaches deny functional specialization, and even Marr v. Gibson on visual processing—and argues that an adaptationist story will be available *however these debates come out*. In my view this is evidence that EP cannot play the primary role in the mind sciences that Barrett wants it to. Here's why.

Barrett commits to a set of claims that shape the argumentative pattern throughout the book. They are as follows:

1. The importance of mechanism: understanding the function of a trait or mechanism depends on understanding its causal roles in the system of which it is a part.
2. The adaptationist axiom: *all* mental features, like all other biological features, must be the result of adaptation by natural selection.
3. The "first law" of adaptationism: "It depends". The way that adaptation has shaped a particular trait or mechanism is entirely dependent on the details of the case.
4. The "centrality" of evolutionary explanation: We can only understand the organization of the mind in evolutionary (adaptationist) terms.

These four claims inspire an argument schema that occurs throughout the book. First, look at a particular mechanistic/information processing account of some trait (action understanding, vision, language, food concepts, theory-of-mind, etc.), as per claim 1. Second, cite the axiom (claim 2) to insist that we need an adaptationist explanation. Third, define an "adaptive problem" that might have been solved by having the mechanism function in the way posited by the mechanistic account (to cover claim 3 for that specific mechanism). Fourth, conclude that the adaptationist explanation is central to the understanding of the system (claim 4). My main concern is that, on Barrett's argument schema, *the adaptationist explanation adds little if any functional understanding to our view of mechanistic organization*.

Consider a mechanism for a psychological trait X, and assume that all are agreed on its current functional role—what it computes and how, and how those computations contribute to mental functioning in general. Suppose, however, that there are differing opinions on the evolutionary story. Perhaps theorists A and B agree that it's an adaptation, but disagree on what adaptive problems it was designed to solve. Theorist C, on the other hand, is convinced that X is entirely due to drift. The point is that, by the argument schema, we've already fulfilled the mechanistic understanding, and therefore the outcome of the evolutionary debate *makes no difference* to our understanding of the mechanism's role in cognitive organization. But, per claim 4, the evolutionary story is supposed to be central to this very understanding—Barrett states repeatedly that we must understand cognitive organization in evolutionary terms. The argument schema fails, on its own terms, to justify the centrality claim.

The reason for this is the combination of claims 2 and 3: the adaptationist axiom and the "it depends" law. Claim 2 says that for every trait there must be an adaptationist story. Claim 3 tells us that there won't be any specific ideas we can draw on in claiming what particular traits will look like and how natural selection shapes them (Barrett, of course, does offer some general characterizations of what natural selection does, but the details depend entirely on the case). Hence, in characterizing the trait we must rely almost entirely on claim 1, the mechanistic description. But because we must already have the mechanistic understanding to embark on the adaptive problem question, the adaptationist explanation in any specific case is entirely parasitic on the mechanistic one. And thus, I claim, it adds nothing substantial to it for understanding mental organization.

To see this clearly, consider just one case in detail—the hierarchical view of visual processing. Barrett argues (and indeed, this is a standard view), that vision "carves up visual processing into different tasks, with some coming before others in the processing and some coming later. Later processes operate on the results of earlier processes" (p. 66). On the hierarchical view, vision works by first having specialized feature-processors operating in parallel, which "tag" stimuli with a bunch of feature values (for edges, motion, color, etc.). Then, object perception tags these assorted features or "cues" as together constituting an object. Then, categorical object perception tags that object as being of a particular type ('face', 'lion', etc.). Similar stories are told for how we perceive animacy and facial expressions. However, the sequential hierarchy implied here has been questioned from a number of angles. Jonathan Cohen and I (Burnston & Cohen, 2013, 2015, drawing on a range of perceptual illusions, have argued that feature representations are not asymmetrically prior (either causally or temporally) to object representations. In general, feature and object processing are mutually constraining, and one only gets definitive object *or* feature representations as a result of the combined evidence for *both* feature and object categories. At the categorical level, Bar (2004) has argued that category assignment to objects relies on contextual cues present in the general scene, and hence that object categorization is in general a combined top-down and bottom-up process. In terms of visual neuroscience, Aflalo and Graziano (2011) have questioned the traditional idea of an anatomical hierarchy in extrastriate cortex, and I have critically examined the idea of a representational hierarchy (Burnston, 2015). Even some of the original and most influential proponents of the hierarchical view of visual cortex—David Van Essen and Daniel Felleman—have changed their minds. They no longer take the evidence to support a division of vision into serial hierarchical processing levels (Hegdé & Felleman, 2007; Hegdé & Van Essen, 2007).

It is entirely possible that all of these claims are wrong, and the hierarchical view in fact right. That's not the point. The point is that we have here a significant question about cognitive architecture, about which there are different competing accounts, and for which the argument schema provides literally *no resources for analysis*. Barrett's claims about the fitness-increasing benefits of dividing up vision hierarchically—for instance that it subsequently allows us to track object permanence by looking for spatiotemporal and/or property continuity amongst already represented features (pp. 70–72)—is based on the supposedly accepted fact that vision is divided up hierarchically. If the non-hierarchical view turns out to be correct, then perhaps another adaptationist explanation can be found for it (an account of object permanence is certainly still important on the non-hierarchical view, and may even still involve elements of the spatiotemporal continuity and property tracking accounts). However, we'll *already know* how vision is organized—non-hierarchically. The adaptationist theory won't make a difference to how we understand mental organization in this case. None of this is to deny, of course, that there is a question about how particular psychological mechanisms come about. That question may even be important and interesting in evolutionary biology. But not all historical questions about X are relevant to every particular explanandum regarding X (otherwise we'd cite the Big Bang a *lot*). I am suggesting that the evolutionary question is one such for explaining the function and organization of psychological mechanisms.

Good types of explanation get the facts right. But they are also, in an important sense, forward-looking. They articulate hypotheses that shape how we investigate the domain. What the above examples show is that Barrett's view of adaptationist explanation fails this criterion. On the schema, all the work is (and must be) done by mechanistic analysis. The adaptationist explanations are a cavalry that only ever shows up after the battle has been won. They're a bench player that you only put in at mop-up time. They're the confectioner's sugar sprinkled on a pastry—maybe nice to have, but ancillary and, ultimately, dispensable. From this view, the many places in which Barrett offers some (contentious) view of a mechanism, then switches to adaptation-speak with some variant of the claim that the mechanism *must* have evolved by natural selection to work that way, are extremely frustrating. It's not (just) that these claims lack evidence or rule out alternatives without argument. It's that they're simply unnecessary for explaining what we want to explain.

I can imagine a world in which evolutionary theory (maybe even including adaptationism) would make a genuine (if not quite *central*) contribution to understanding mental organization. *If* we had sufficient evidence to constrain evolutionary hypotheses about mental traits, *independently* of mechanistic considerations, and *if* we had a principled way of applying those considerations in the context of subsequent causal/functional analysis, we might hope for a kind of pluralism where evolutionary and mechanistic understandings would mutually further and support each other.

I can imagine such a world, but Barrett doesn't prove that we're in it. In fact, his argument schema seems to preclude our passing its borders. Hence, as far as EP goes, number me still among the unconvinced.