

delusional content in the first place? (2) Having once entertained a particular thought, why does a deluded patient cling to it rather than reject it? Sometimes the answers will be neuropsychological and sometimes they will be motivational.

But, even if the aetiology of the second break is sometimes motivational and sometimes neuropsychological, the second break might still be similar at an *on-line* cognitive level. M&D's idea of "doxastic shear-pins" is relevant here. If belief-making components shear in situations of extreme psychological stress to permit beliefs that would ordinarily be rejected, I assume that the shearing is localized and constrained by the context. I also assume that the shearing involves some on-line neural/cognitive "short-circuit," as opposed to a stable neuropsychological impairment. If so, then perhaps we might describe the second break in all delusions, bizarre or mundane, as a "doxastic inhibitory failure": a failure to "demote" a belief so as to reason about it as if it might not be true. In bizarre monothematic delusions, this failure might only manifest via an inability to inhibit a default tendency to upload and maintain (distorted) perceptual experience into (mis)belief; in mundane motivated delusions this failure might only manifest when the psychological cost of demoting the belief into a "maybe-it's-not-true" mental space is too great; and in dementing patients with widespread bizarre and/or mundane delusions this failure might reflect more general inhibitory compromise.

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Are beliefs the proper targets of adaptationist analyses?

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Abstract: McKay & Dennett's (M&D's) description of beliefs, and misbeliefs in particular, is a commendable contribution to the literature; but we argue that referring to beliefs as adaptive or maladaptive can cause conceptual confusion. "Adaptive" is inconsistently defined in the article, which adds to confusion and renders it difficult to evaluate the claims, particularly the possibility of "adaptive misbelief."

McKay & Dennett (M&D) open their article by presenting what they consider the "prevailing assumption" (sect. 1, para. 2) of modern evolutionary analyses of belief, namely, that true beliefs are adaptive and misbeliefs maladaptive. However, M&D also present and appear to endorse the content of several quotations (e.g., from Bloom 2004; Ghiselin 1974; Haselton & Nettle 2006; Stich 1990) that showcase an alternative evolutionary perspective: that beliefs are not relevant to natural selection unless they contributed recurrently to differential reproduction, and, furthermore, that there is no reason to assume that only the true beliefs of our ancestors met this criteria. These quotes suggest that what M&D refer to as the "prevailing assumption" of evolutionary analyses of belief is in fact *not* the prevailing assumption; but this is a relatively minor issue that we do not explore further in this commentary. Instead, we address a more pressing concern: M&D's analyses are not based on a coherent definition of "adaptive."

The aim of the target article is to evaluate the assumption that misbeliefs *themselves* are maladaptive, and to examine

candidates for *adaptive misbelief*. Considering this aim, we find it surprising that M&D do not provide coherent definitions of the relevant phenomena. Adaptive misbeliefs are loosely defined at various places in the article as beliefs that are "normal" (sect. 5, last para.), "beneficial" (sect. 6, first para.), that "aid survival" (sect. 6, first para.), "maximize fitness" (sect. 9, para. 5), "facilitate the negotiation of overwhelming circumstances" (sect. 10, para. 2), "facilitate the successful negotiation of social exchange" (sect. 12, first para.), promote "mental health" (sect. 13, first para.), and "sustain and enhance *physical* health" (sect. 13, para. 3, emphasis in original). M&D do not explicitly define "adaptive misbelief." Rather, they pose several questions throughout the article in the process of evaluating the plausibility of adaptive misbelief, and these questions imply the sundry definitions we noted. Because it does not provide a specific definition of "adaptive," the article lacks a consistent framework for evaluating the candidates for adaptive misbelief.

Although M&D acknowledge in a note (Note 3) that they conflate conceptually "adaptive" and "adapted" throughout the article, this acknowledgement does not diminish any confusion, as the reader is left without a specific definition for either term. M&D also highlight the distinction between psychological adaptation and biological adaptation. These terms are loosely defined with reference to a distinction between "human happiness and genetic fitness" (sect. 10, para. 5) – with genetic fitness loosely defined as "having more surviving grandoffspring" (sect. 10, para. 5). The latter definition misses many of the conceptual nuances associated with the concept of fitness from an evolutionary perspective (see Dawkins 1982). Such an oversimplification is particularly problematic for an article whose arguments hinge on whether beliefs have had an effect on fitness throughout our evolutionary history, which would ultimately determine the status of beliefs as adaptations in and of themselves.

M&D do avoid a potential confusion in their article by making a clear distinction between beliefs themselves and the information-processing mechanisms that generate beliefs (sect. 5, last para.). M&D clearly state that they are interested in the subset of misbeliefs that are generated by properly functioning cognitive mechanisms, and that these are the candidates for adaptive misbelief. However, M&D do not justify focusing on beliefs themselves as opposed to the mechanisms that generate beliefs, even though a proper adaptationist perspective (Tooby & Cosmides 1992) focuses not on the output of adaptations (e.g., beliefs), but on the design features of the adaptations (e.g., the information-processing mechanisms that generate beliefs). If the information-processing mechanisms of the mind are sensitive to context (Buss et al. 1998), then it is plausible that a belief-generating mechanism can generate true beliefs in one environment and false beliefs in a different environment. Our understanding of why specific beliefs are formed requires an understanding of the mechanisms that generate the beliefs, and referring to beliefs themselves as adaptations obfuscates the importance of the actual adaptations (i.e., the underlying mechanisms).

Despite some conceptual confusion, M&D present several thought-provoking concepts in the target article. For example, their categorization of misbeliefs in terms of the functioning (or malfunctioning) of the belief formation systems provides an important distinction, although we were surprised to see no reference to Wakefield's (1992) strikingly similar and pioneering evolutionary analyses of dysfunction. We also appreciate the concept of "doxastic shear pins" (sect. 10), which may offer a solid foundation for future empirical and theoretical work on belief formation in extraordinary, psychologically stressful situations. Finally, M&D's analysis of beliefs suggests an alternative to the proper adaptationist perspective by referring to the *output* of psychological mechanisms as adaptations. However, the merit of this alternative is difficult to determine, due to the target article's many conceptual confusions.