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WHY HUMAN GRANDMOTHERS MAY NEED LARGE BRAINS
Commentary on Skoyles on Brain-Expertise

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Abstract

Skoyles's case against human brain size being related to IQ is strong; but his case in favor of its being related to expertise is weak. I propose that the explanation for the evolutionary expansion of the human brain in fact lies far away, in the need to have a brain that could continue to function into old age.

1. Skoyles (1999) has presented a knock-down case that the evolutionary function of having so large a brain as that of contemporary humans cannot be merely to boost general intelligence as measured by IQ. In fact the evidence he reviews suggests that IQ asymptotes at a brain size of around 750 cc, so that Homo erectus may have been every bit as clever by this measure as we ourselves are. Why then should there have been the further enlargement of the brain in evolution?

2. Skoyles reasonably argues that if the extra brain mass does not contribute to general intelligence, it must contribute to something else that is evolutionarily advantageous. And his favour ed candidate for this something else is expertise. Others, including myself, have made alternative suggestions, such as that extra capacity is required for the development of specialisms such as social skill, or language, or reflexive consciousness (reviewed in Mithen, 1994). Calvin, coming at the problem from a different angle, has proposed that a huge increase in raw computing power was needed for humans to be able throw projectiles to hit small targets (Calvin, 1983).

3. However, the evidence reviewed in this paper would seem to make trouble for every one of these suggestions - including Skoyles's own. For what the case studies seem to show is that individuals with very small brains can function more or less normally, not only on IQ tests, but in every other important way as well. To be specific, when a man such as Daniel Lyon, with half the normal brain mass, is described as having “nothing defective or peculiar about him,” we should take it — unless there is specific evidence to the contrary — that not only is his general intelligence in the normal range but so too is his social skill, language, consciousness, and indeed his throwing skill. Skoyles would no doubt want to suggest that, even so, future research may reveal that anyone with so small a brain would have to be lacking expertise. But as yet, as I understand it, this suggestion remains pure hypothesis.

4. Extraordinary evidence perhaps requires extraordinary theoretical reorientation. Twenty years ago there was an article in Science that described John Lorba’s observations on hydrocephalics who have severely depleted brain tissue, yet normal mental functioning. It was titled “Is your brain really necessary?” (Lewin, 1980). For just the reasons Skoyles gives about the survival costs of having a large brain, we can surely reject the idea that big brains really are unnecessary — in the sense that they bring no additional benefits whatever. Even so, perhaps we should still entertain the possibility that, beyond a certain size, extra brain tissue really may be effectively redundant. And yet there may still be a great advantage to possessing it, for a different and surprising reason.

5. My own proposal, in short, is that the evolutionary advantage to modern humans of having a large brain is that it helps us to live longer — or, more specifically, that it helps to insure our intellectual competence into an older old age.

6. The brain is of course a fragile organ, which is vulnerable not only to external knocks, and internal hemorrhages and tumors, but also to intrinsic processes of cell death and decay. By the time we reach middle age, the brains of every one of us will almost certainly have suffered significant structural damage. Yet the fact is that the majority of us will not yet have suffered any obvious intellectual loss. The reason is that, fortunately, we have more than enough brain to make up for it.

7. Skoyles himself hints at this very point about the value of redundancy when he writes in para. 30 that “the brain can easily recover from injuries incurred in small stages . . the brain loss that occurs slowly can pass without notice. For example, asymptomatic meningioma can grow (at an average of 2.4 millimeters a year) into the size of plums without noticeable

effect." My point is that the reason why the meningioma can grow so large without noticeable effect is precisely because there is sufficient spare tissue to cover for whatever is being slowly damaged.

8. Redundancy exists elsewhere in the human body, and the explanation may well be the same. Consider for example the question of why we have two kidneys. The value of our having two kidneys rather than one is not that this doubling-up allows us to perform excretory functions differently or better. Rather it is that if and when something goes wrong with either one of the kidneys, the other one can take over the whole job.

9. Someone born with only one working kidney could in fact expect to manage quite well for many years. However, in the longer run he would be significantly more likely to die an early death from renal failure. By the same token, perhaps, someone born with a Homo erectus sized brain could expect to hold his own intellectually for thirty years or so. But in the longer run he would be significantly more likely to die from brain failure.

10. How long did our Homo erectus ancestors typically live? There are no reliable estimates. But it is clear from comparisons across the higher primates that life expectancy has in fact increased progressively along the line that led to Homo sapiens (with chimpanzees for example living twice as long as baboons, and contemporary humans living twice as long as chimpanzees). A good guess would be that Homo erectus adults almost never lived beyond forty years, being likely to die by that time from accident or disease, even if their brains were still quite healthy.

11. This relatively short life-expectancy might explain why at that stage there would have been little if any immediate selection pressure for an increase in brain size to provide spare capacity. For, even though these Homo erectus individuals would arguably have run a high risk of dying of brain failure if they had lived longer, the fact was they were almost all already dead by the time these risks kicked in.

12. Modern humans, however, have evolved to have a considerably longer life-expectancy. Indeed by 100,000 years ago, a good many adults were probably living into their sixties or even seventies. Thus the selection pressure for developing a more redundant brain, capable of recovering from damage, would have become much stronger. This could well have resulted in the rapid doubling in brain size to the levels that are normal today.

13. The adaptive value of longer life — especially a life that in women typically extends well beyond the menopause — is still not clear. But it is plausible to suppose that as human survival became increasingly dependent on culturally acquired subsistence skills, and as social life grew ever more complex, there would have been considerable advantage to families from having living grandparents and even great-grandparents around (see Hawkes, 1997).

14. In sum, I suggest that small brained individuals, for all that they may have normal IQ and indeed normal expertise, have seldom lived long enough to tell stories to their grandchildren. So that evolution has passed them by.

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