Psychology 429: The Development of the Social Brain
Weekly Assignment

Part A: Summary Section

Article: Dunbar, R. I. M. (1992). Neocortex size as a constraint on group size in primates. *Journal of Human Evolution*, 22(6), 469-493.

1) Review of the main points of the paper (2-3 sentences):
Using comparative evolutionary research techniques, Dunbar suggests that social intellect theory, which asserts that greater thinking abilities and larger brain sizes arise due the social pressures that require complex manipulation, is the main driver behind larger neocortical volumes, as opposed to deriving solutions to environmental problems (ecological theory). Furthermore, there are limitations on the number of individuals that can efficiently be tracked and therefore the number in a closely-bonded group is restricted to the processing ability (i.e. the size of the neocortex area) of the organism. Results showed a relation between relative brain size and group size, suggesting it is likely that the average group size of a species can only increase if there is an increase in processing ability (i.e. larger brains with more neocortex).

2) Two strengths of the research (and explain why): a) I liked that there was an attempt to give a quantitative explanation for why neocortex sizes increased in primates by examining two major potential contributors: social and ecological drivers. Given a more functional viewpoint of the various brain regions I like that Dunbar tried to be more specific in terms of what area of the brain should be measured and also tried different ways to measure neocortex volume. I feel this attempt opened up an important discussion of what is the best way to measure brain structures in evolutionary studies. I'm not sure there was a satisfactory answer to the best way of measuring brain anatomy but at least some of the issues were illuminated. b) I liked that there was a look at the different kinds of reasons that groups may stay together which I felt help a more convincing argument that it was the absolute number of meaningful connections that was associated with neocortex volume rather than a specific subset such as number of dominant leaders, or number of females etc. I think it is important to make distinctions about the type of social interactions that exist and the level of detail it requires to engage in those interactions. For example, it probably takes less mental energy to simply follow commands from a leader than to figure out a way to get a particular item from your enemy.

3) Two weaknesses of the research (and explain why): a) Based on what is known about the integrative function of cognition, I don't feel there should be such a distinction between social and ecological demands in brain processing. It seemed that the article started on the premise that only one of the three hypotheses best predicts differences in brain size rather than an alternative hypothesis that they co-exist and maybe influenced different brain structures in different ways that was not captured when looking at the entire neocortex volume. It may be that there cannot be a useful social interaction without challenges posed by the environment that in turn might be constrained by working memory capacity. b) Dunbar focused only on primates but it is my impression that there are other taxa that are highly social that may or may not have a large neocortex volume compared to the rest of the brain. For example, sea and river otters, or Dolphins have rather complicated social networks that may be adaptations to the environment (i.e. how to drive fish into a ball for easier consumption, or coordinating who is attacking where) and I felt more discussion of environmental pressures on social coordination was needed.

4) One quiz question that you might pose to your classmates with the correct answer:
Name three potential ways of measuring differences in neocortex size between different species/genus? The absolute neocortex volume, the neocortex ratio to bodyweight, and the neocortex ratio to the rest of the brain.

5) One research question to pursue in the future (and explain why):
One research question that could be pursued would be to look at the brain sizes of the nocturnal prosimians. In the discussion, Dunbar notes that the larger range in these nocturnal species could be interpreted in two ways: they are constrained by their feeding ecology or habitat; or that the true group size is larger than the assumed value. Testing whether the range is due to their habitat or having a larger group size would allow better judgements to be made about the data of these prosimians.

Part B: Question Section

Article: Dunbar, R. I. M. (1992). Neocortex size as a constraint on group size in primates. *Journal of Human Evolution*, 22(6), 469-493.

Question 1: In the selection of variables section of the paper, Dunbar mentions that it is not clear what criteria should be used to define a group (pp. 471) and ultimately decides to look at the number of individuals that were part of the regular contact unit, but is there a better way of defining groups in terms of the level of cognitive load imposed on an organism?

Question 2: While it makes sense that in primates neocortex volume is the component that underwent the most evolutionary change it still covers a wide area of cortical tissue, are there ways of defining more specific social and spatial areas in primate brains?

Question 3: I wasn't sure what had been meant in the discussion when Dunbar says that various genus fell onto higher or lower grades of the regression line. He states that this is evidence of their body size but I wasn't sure how the relationship was made.

Article: Baron-Cohen, S. (1995). Chapters 1-3. *Mindblindness: An essay on autism and theory of mind*. MIT Press.

Question 1: How complicated does an organism need to be in order to predict the behavior of others? For example, Octopus's have anecdotally been found to be able to predict the schedules of their caretakers and their neural mechanisms aren't as complex as a humans.

Question 2: In Chapter 2 (pp. 15) there is specific mention that primates must have an ability to not only predict the behavior of others but also find ways to manipulate it. What if there is some other driving force that requires the ability to predict and manipulate behavior? For example, gophers predators will try to find ways to manipulate the hole at which a gopher will pop out of. Sometimes there are several species that are interacting for a particular outcome and while it's not a social interaction in the traditional sense it is still a prediction and manipulation of behavior.

Question 3: Why is it that there is such a gradient in autistic children's ability to manipulate others if evolutionarily it is so important to have efficient theory of mind? Given the increased emphasis on accommodation of disabilities in educational settings does a lack of theory of mind hinder as much as it used to?

Article: Humphrey, N. K. (1976). The social function of intellect. *Growing points in ethology*, 303-317.

Question 1: It doesn't make sense to me that there isn't some "extravagance" for evolution given the incredibly elaborate mating displays of some birds of paradise, or the development of spandrels in the body. Perhaps in a particularly primitive environment every last morsel of energy must be conserved but is intellect constrained by energy demands like body size is?

Question 2: Would social intelligence be considered part of low-level (inferring stuff based on similar cause-effect patterns pp. 304) or high-level (something novel about to happen pp. 304) intelligence? Does it depend on the social situation? If so, what kind of social situations would drive evolution if the two were related?

Question 3: If social communication is central to the great apes and our daily lives and requires adaptability according to the appropriate situation, why is it not considered under practical invention?