Why Humans aren't just Great Apes

Professor Robin Dunbar FBA *gave the 2007 Joint British Academy/British Psychological Society Lecture. He argued that the real difference between humans and the great apes lies in our ability to live in the virtual world of the mind. Story-telling plays an important role in social bonding in all human cultures, and it requires us to be able to imagine worlds that do not physically exist. In this edited extract, Professor Dunbar discusses the significance of the human 'social brain' and its computational power.*

Humans and the Social Brain

Modern humans have much larger brains (and especially neocortices) than other primates, and we can legitimately ask what the relationship between neocortex size and group size in primates can tell us about human group sizes. As Figure 1 suggests, there are quite distinct grades in this relationship within the primates: apes lie to the right of monkeys, and monkeys lie to the right of prosimians, suggesting that servicing groups of a given size requires proportionately more computational power as you pass from prosimians through monkeys to the apes. Hence, the appropriate regression line from which to predict human group sizes is that for apes. Interpolating the modern human neocortex ratio into the ape equation yields a predicted group size of around 150 (Figure 1).

A search of the ethnographic literature revealed that this is in fact the typical size of hunter-gatherer communities. More remarkably perhaps, this figure of ~150 appears frequently in many aspects of historical and contemporary human organisation (Table 1). It was the mean village size recorded for almost all English counties in the Doomsday Book as well as during the eighteenth century, and is the typical size of the company in most modern armies, the number of recipients of a typical Christmas card distribution list in Britain, and the size of the social network in reverse 'small world' experiments, amongst others. Thus, a wide range of contemporary social phenomena seem to yield much the same kinds of grouping patterns, despite marked differences in both scale and organisation. The only substantive difference between social networks in traditional hunter-gatherer and agricultural societies and modern post-industrial societies seems to be that, in traditional societies, everyone in the community has more or less the same network of 150 acquaintances, whereas in modern urban societies our networks are highly fragmented – my 150 consists of a set of sub-networks that barely overlap. You and I may share one small set of friends, say through work, but there is no overlap at all in the remaining subsets – we do not share any relatives, nor do we share hobby circles, church networks, spouses' friends, schoolgate friends (the often temporary friendships built up through one's children's school friends) or sports club friends. Networks in modern societies are fragmented and dispersed (often over considerable geographical distances), whereas in traditional societies they typically form a single cohesive community – even though that community itself may be

Figure 1: *Mean social group size for different species of primates (prosimians, monkeys and apes) plotted against relative neocortex size (indexed as neocortex ratio, the ratio of neocortex volume divided by the volume of the rest of the brain). Ape species are distinguished as open symbols (lower left to top right: gibbons, gorillas, chimpanzees and modern humans). The point labelled for humans is that predicted by the ape regression equation.*

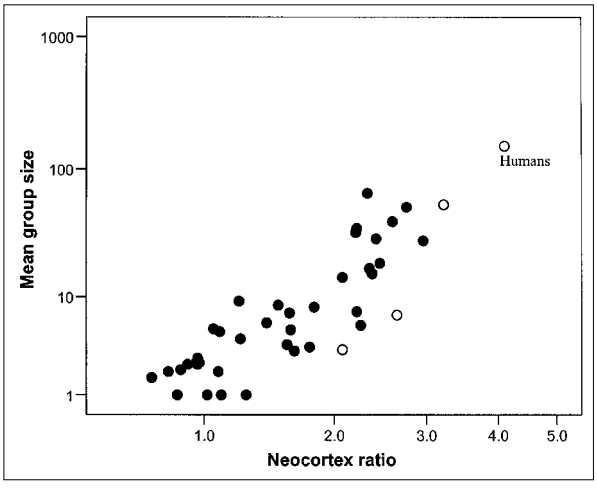

Table 1: *Examples of human social groupings that conform to the predicted size of ~150 individuals*[1]

Grouping	Typical size	Source
Neolithic villages (Middle East, 6500-5500 BC)	150-200	Oates (1977)
Maniple ('double century') (Roman army: 350-100 BC)	120-130	Montross (1975)
Doomsday Book (1085): Average county village size	150	Hill (1981), Bintliff (1999)
C18th English villages (mean of county means)	160	Laslett (1971)
Tribal societies (mean and range of communities; *N*=9)	148 (90-222)	Dunbar (1993)
Hunter-gatherer societies (mean clan size; *N*=213)	165	Hamilton *et al* (2007)
Hutterite farming communities (Canada) (mean, *N*=51)	107	Mange & Mange (1980)
'Nebraska' Amish parishes (mean, *N*=8)	113	Hurd (1985)
Church congregations (recommended ideal size)	200	Urban Church Project (1974)
E. Tennessee rural mountain community	197	Bryant (1981)
Social network size (mean, *N*=2 'small world' experiments)	134	Killworth *et al* (1984)
Goretex Inc: factory unit size	150	Gladwell (2000)
Company (mean and range for 10 World War II armies)	180 (124-223)	MacDonald (1955)
Christmas card distribution lists (mean total recipients: *N*=43)	154	Hill & Dunbar (2003)
Research specialities (sciences and humanities) (mode, *N*=13)	100-200	Becher (1989)

[1] Confidence intervals around the predicted mean are 100–200.

Figure 2: *A human social group – people chatting between lectures at the Dartington 'Ways with Words' literary festival. Photo: the author.*

distributed over a wide geographical area (as in many contemporary hunter-gatherers).

This figure of ~150 seems to mark a distinct limit for relationship quality: there seems to be a marked difference in the quality of the relationships we have with those who are inside the chosen circle versus those who are outside. My informal definition for this limit to our social world is that it is everybody whom we know as persons, everyone with whom we have a definable personal relationship. Those inside this circle are individuals towards whom we feel some sense of obligation, whom we trust would help us out if we so requested, who would reciprocate our sense of personal commitment. We know where these individuals fit into our network of relationships, they know where we fit into theirs, and our knowledge in both cases is based on personal acquaintance. Sometimes, that knowledge can be indirect (friends of friends, or a shared grandparent), but it defines those to whom we owe personal obligations; if we offend them, or spurn them in some way, that offence will come to haunt us through the effect it has on the relationships that link us. In contrast, beyond this circle of 150, people cease to be individuals, at least in so far as our relationships are concerned. Even though we recognise them as individuals (i.e. we can put names to faces), our relationships with them are less personal and more typological. We need rules of thumb to guide our interactions with them rather than being able to rely on personalised knowledge. In such cases, the rule is usually cued by some appropriate badge that signifies the status of an individual and how we should address them – uniforms, badges of rank, styles of speech, and so on.

As with all primate social groups, human social networks are highly structured. We do not interact equally with all members of our immediate social world. Rather, it seems that our social world consists of a series of hierarchically inclusive circles of acquaintanceship that are reflected in both the perceived intimacy of the relationship and the frequency of interaction. These circles of acquaintanceship seem to have a very consistent structure: each annulus includes about twice as many people as the one immediately inside it, so that the cumulative numbers of individuals included in successive circles exhibit a constant scaling ratio of approximately 3. Roughly speaking, they progressively include 5, 15, 50, 150, 500 and 1500 individuals, and, for all we know, may extend beyond that in a further series of circles that have the same ratios.

The Role of Cognition

The fact that brain size correlates with social group size implies that this involves a cognitive limit. However, we know surprisingly little about the kinds of cognition that might be involved in managing social relationships. Although everyone probably agrees that this is some form of 'social cognition', quite what that entails remains unclear. The only aspect of this that we know much about is what has become known as theory of mind. Theory of mind is the ability to reflect on another individual's mind states. As such, it is one level in a potentially endless reflexive series of mind states and beliefs about mind states known as the levels of intentionality. We know a great deal about theory of mind (which is equivalent to second order intentionality) because developmental psychologists have explored it in considerable depth. In simple terms, it is the cognitive rubicon that children pass through at about the age of 4–5 years, although some individuals (such as autistic people) never achieve this even as adults. However, the problem with theory of mind is that while we know a great deal about its natural history, we have almost no idea what it actually is.

Nonetheless, even though the exact processes involved may be somewhat opaque, we can perhaps use the notion of intentionality to give us some purchase on the problem of how humans differ from other primates since the orders of intentionality form a natural scale, and thus seem to provide us with an index of social cognitive competence (as indexed by the ability to hold several individuals' mental states in mind at the same time).

This being so, our main interest at this point is what the natural limits of intentional reasoning might be in humans. We have tested normal adults in a number of separate studies, and it seems that the limit of function for adults is consistently fifth order ('I *believe* that you *suppose* that I *imagine* that you *want* me to *believe* that…'). Around two-thirds of individuals have their limit at or below fifth order intentionality, and around three-quarters have their limit at or below sixth order. These competencies develop over a period of time between age 5 (when children first acquire theory of mind, or second order intentionality) and the early teens (when they finally acquire fifth order adult-level competencies).

Intentionality and the Virtual World

The issue of interest here is what can be achieved with different levels of intentionality. If intentional competencies allow us to hold several different individuals' mind states in mind at the same time, then it seems likely that it will impose constraints on cultural phenomena

that require us to think intentionally. This is perhaps most obvious in the case of imaginative play. The psychologist Alan Leslie noted that theory of mind may be crucial for children to be able to engage in fictive (i.e. pretend) play where they have to imagine that the world is other than it really is (i.e. dolls can drink tea, the steering wheel on the back of a chair is a real car). Leslie's point can be extended to drama. Consider the case of the audience watching Shakespeare's *Othello* (Figure 3). They have to believe that Iago intends that Othello imagines that Desdemona is in love with Cassio, an activity involving four levels of intentionality. However, notice that, at this point, the kind of story they are dealing with is not especially demanding (or, for that matter, particularly enthralling). Why should Othello care if Desdemona fantasises about Cassio? The bottom line of everyday life is that very few of us would be anything but mildly bemused by such a trivial phenomenon, and the story would end there as a dull narrative. What gives Shakespeare's play its bite is the fact that Iago is able to persuade Othello that Cassio reciprocates Desdemona's feelings, thereby creating a romantic triangle and raising the stakes high enough for all of us to be gripped by the drama (especially when, with the benefit of spectator-sight, we are aware of Iago's scheming plan). At this point, of course, the audience is having to work at fifth order intentionality, and is thus at the natural limits for the great majority of the population.

But, in putting this story together, Shakespeare himself has to go one level higher than his audience, to sixth order: he has to *intend* that the audience *believes*…. I suggest that this might explain why the capacity to enjoy good literature is a widespread human universal, but the ability to *compose* good literature is not – storytelling demands social cognitive competencies that are beyond the normal range for the great majority of the population. Thus it is that, when we sit down to write those novels we have so long aspired to write, our natural limits at fifth order intentionality constrain most of us into writing dull narratives.

Figure 3: *Higher orders of intentionality are involved in this scene from Othello. (Time & Life Pictures/Getty Images)*

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Lucy to Language

Robin Dunbar is British Academy Research Professor at the University of Liverpool. He co-directs the British Academy's Centenary Research Project, *Lucy to Language: The Archaeology of the Social Brain* (www.liv.ac.uk/lucy2003/). In *British Academy Review* Issue 9 (2006), he reported on the first phase of the research programme, and there drew early attention to the apparent significance of the number 150 as a human group size – what has now become widely referred to as 'Dunbar's Number'. A conference entitled 'Social Brain, Distributed Mind' is being held at the British Academy in September 2008.

The *Lucy to Language* Project's research into how human communications and social networks have evolved over millions of years is proving relevant to the needs of communications specialists. Professor Dunbar is part of a Europe-wide consortium running a project entitled 'Social Networks for Pervasive Adaptation' (SOCIALNETS, www.social-nets.eu/) – which has recently been awarded an EU research grant of approximately £2 million. The project takes insights into our ability to communicate and create social groups (with a particular interest in Dunbar's Number), and applies them to the development of new communications technology. According to Professor Dunbar, 'This is a radical departure from the traditional engineering notion of a communication network. Instead we are seeking to embed in communication devices the key characteristics that have enabled humans to evolve and exhibit agility way beyond any other species. This can be exploited for communication and knowledge acquisition for a large numbers of devices in the future.'

The full text of this lecture will be published in *Proceedings of the British Academy*, volume 154.