with Bill Frost that was begun in Getting's lab.

I also have been very interested in the evolution of neural circuits. As a graduate student, I was influenced by the work of Dorothy Paul and Edmund Arbus. I think that understanding a neural circuit means also understanding its evolutionary history. It's a mistake to try to analyze a circuit as if it were 'created' for its current function.

Speaking of creation versus evolution, what's your opinion about the current troubles in the US regarding teaching 'intelligent design'? There is a perception in this country that evolution somehow conflicts with religion. So some politicians are attempting to gain the favor of the religious fundamentalists by favoring the teaching of 'alternatives to evolution'. But as was recently pointed out by a Federal Judge in Dover, Pennsylvania, the supposed alternatives are based on religious beliefs, not science, and so may not be taught in public school science classes. In my state, we formed a group called Georgia Citizens for Integrity in Science Education, which has successfully fought against efforts to undermine the teaching of evolution and other scientific concepts. It is essential that scientists speak up on this issue. We should not sit idly by while popular sentiment is whipped up against the scientific process. If 'materialist' explanations fall to supernatural explanations, then we will be taking a major step backward.

So, do you think that the problem is that scientists generally are not political enough? I think that scientists tend to be too passive with political questions. It's important for politicians to know there is a political cost to pandering to anti-scientific groups. Scientists should write letters to newspapers and their government representatives whenever they can provide illumination on a question of public concern.

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## Correspondences

# Referential gestural communication in wild chimpanzees (*Pan troglodytes*)

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Humans commonly use referential gestures, for example pointing, which direct the attention of recipients to particular aspects of the environment [1]. The use of these gestures has been linked with cognitive capacities such as mental state attribution [2,3] because the recipient must infer the signaler's meaning. In our closest living relatives, the non-human primates, referential gestures have been reported only in captive chimpanzees interacting with their human experimenters [4] and human-raised or languagetrained apes ([5-7]; but see also [8]). Here we provide the first evidence for the widespread use of a referential gesture by wild chimpanzees (Pan troglodytes).

Observations of the Ngogo community in Kibale National Park, Uganda, indicate that wild chimpanzees use '*directed*  scratches' to request grooming of specific body areas. The gesture involved one chimpanzee making a relatively loud and exaggerated scratching movement on a part of his body, which could be seen by his grooming partner (a movie clip of the 'directed scratch' can be found in the Supplemental Data available on-line with this issue). It occurred between pairs of adult males and was recorded 186 times in 101 (41%) of 249 grooming bouts. One hundred nineteen times (64%), the groomer stopped grooming and groomed the scratched spot. Eight times (4%) individuals simultaneously scratched and presented a body part and were groomed there immediately. In 59 cases (32%), the groomer continued to groom without touching the area scratched by the signaler. The gesture received significantly more positive than negative responses (p < 0.001; exact binominal test) and occurred in 61% (N=51) of all observed grooming dyads (N=84). It was performed on average 3.65 times per dyad and was used significantly more often in dyads consisting of high ranking males than other possible pairings (p < 0.001; df=6, linear-linear)association: Figure 1).

Three hypotheses may account for these observations. First, the *'directed scratch'* may not represent

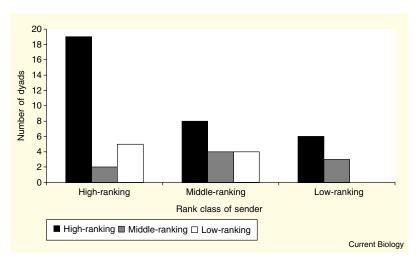
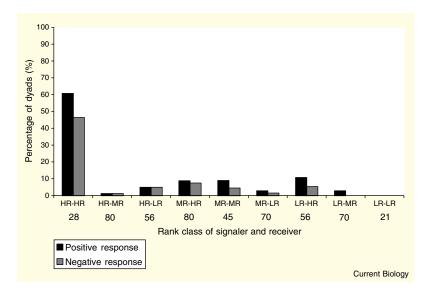


Figure 1. Occurrence of the '*directed scratch*' in relation to male dominance rank. The y-axis indicates the number of observed dyads; the x-axis indicates the dominance rank of the signaler. The three different colours indicate the ranks of groomers, the recipients of signals.





The y-axis indicates the percentage of observed dyads; the x-axis shows all possible combinations of rank dyads. The first two letters indicate the rank of the signaler, the last two letters the rank of the recipient or responder. The potential number of rank dyads is shown beneath each dyad. The two different colours indicate whether a 'directed scratch' received a positive or a negative response. HR, high rank; MR, middle rank; LR, low rank.

a communicative signal, but instead reflect behavioural conformity due to stimulus enhancement [9]. For example, the scratching movement may simply facilitate grooming with the recipient, who simply learns the contingency rule "if he scratches my grooming is tolerated." If this hypothesis is true, then we would expect to find a positive response mainly from low-ranking males towards high-ranking males, but this is not the case (Figure 2).

Second, 'directed scratching' might simply represent a physical response by an individual to parasites or dirt, thereby drawing the attention of the groomer to a potential area to groom. This hypothesis suggests that 'directed scratches' would be displayed uniformly across all grooming dyads, a prediction that does not accord with our observations (Figure 2).

Third, the gesture may be used communicatively to indicate a precise spot on the body and to represent a desired future action, namely grooming. Consistent with this hypothesis is the finding that in the majority of cases, individuals immediately groomed the indicated spot.

Our observations suggest that the recipient of the signal has an

understanding of the intended meaning of the gesture and that wild chimpanzees use gestures to specify an area of the body to be groomed and to depict a desired future action. They therefore qualify as referential and iconic [10] and reflect greater signal specificity than related gestures such as 'raise arm' and 'present back' [11], which request grooming of larger body areas that are difficult to access.

In sum, the frequent use of and responsiveness to 'directed scratches' by male chimpanzees at Ngogo imply that some form of mental state attribution may be present in our closest living relatives.

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### Supplemental Data

Supplemental data including a movie showing the '*directed scratch*' are available at http://www.current-biology. com/cgi/content/full/16/6/R191/DC1/

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