Correspondence

Road-crossing in chimpanzees: a risky business

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During group movements, monkeys may cooperate to reduce the risk of predatory attacks through adaptive spatial patterning. For example, adult males move toward the front of the group when travelling towards potentially unsafe areas such as waterholes, and bring up the rear when retreating [1-4]. Comparable data on progression orders in moving groups of great ape are lacking.

We hypothesised that chimpanzees evaluate risk when crossing roads, and draw on a phylogenetically-old principle of protective socio-spatial organization to produce flexible, adaptive and cooperative responses to risk. Progression orders were studied in the small community of chimpanzees (Pan troglodytes verus) at Bossou, Guinea as they crossed two roads, one large and busy with traffic, the other smaller and frequented mostly by pedestrians. We found evidence that the degree of risk, estimated in terms of the width of roads and the amount and type of traffic they carried, influenced the waiting time before crossing the roads and the order in which the chimpanzees crossed.

The home range of the 12-strong chimpanzee community at Bossou (7? 39?? N; 8? 30? W), covers about 15 km² of mixed forests surrounded by abandoned and cultivated fields. It is dissected by a narrow road (3 m wide) which is used by pedestrians, and a recently widened larger road (12 m wide at the crossing point), which carries trucks, cars, motorbikes and pedestrians. There is forest up to the edge of the roads, the latter being separated by secondary forest and plantations. Two observers recorded progression orders in both directions (Figure 1); the first chimpanzee to scan the road was termed first individual to scan. The latency between arrival of the first individual to scan and the last group-member to cross the forest-road edge was termed the waiting time. During the study (January-April 2005), the group contained three adult males, five adult females, three juveniles and one infant [5].

Figure 1 How do chimpanzees cross roads?
Dominant individuals act cooperatively with a high degree of flexibility to maximise group protection.

Waiting time was analysed for 19 combined road-crossings in which the same group members crossed the two roads. The analysis of road-crossing progressions used data from 28 mixed-group progressions (17 small and 11 large road crossings), with mean group size 10.6 individuals (SD 2.1). Chimpanzees waited longer before crossing the large road than the small road (means: 180 versus. 24 seconds; Wilcoxon test: $T = 5$, $N=19$, $p < 0.01$). Presence or absence (either auditory or visual) of people had no effect on waiting time on the small road (Mann-Whitney test: $Z = -0.168$, $N = 19$, $p = 0.905$), but people ($Z = -2.059$, $N = 19$, $p = 0.043$) and vehicles ($Z = -2.043$, $N = 19$, $p < 0.01$) increased waiting time on the large road. A significant effect of direction of travel emerged concerning the large road ($Z = -2.083$, $N = 19$, $p = 0.041$); the same effect for the small road approached significance ($Z = -1.915$, $N = 19$, $p = 0.062$): the chimpanzees took longer to move from forest to more open areas than vice-versa.

When all three adult males were present, one led more often than expected (18 of 28 progressions; binomial test: $p < 0.001$) and was more likely to scan the road prior to crossing (binomial: $p < 0.001$). In contrast, an adult male did not occupy the rearmost position more frequently than expected. As the second- and third-ranking males frequently led, the frequency of the alpha male being last was tested; this was highly significant (Bonferroni correction included; binomial: $p < 0.01$).

Figure 2 summarizes the progression order data. The first individual to scan was the first to cross the small road in 100% of cases, compared to 70% for the large road. On the large road the second-ranking male sometimes continued scanning while the elderly third male and alpha female took up the lead on the large-road progressions. The alpha male increased his rearward presence on the large road,

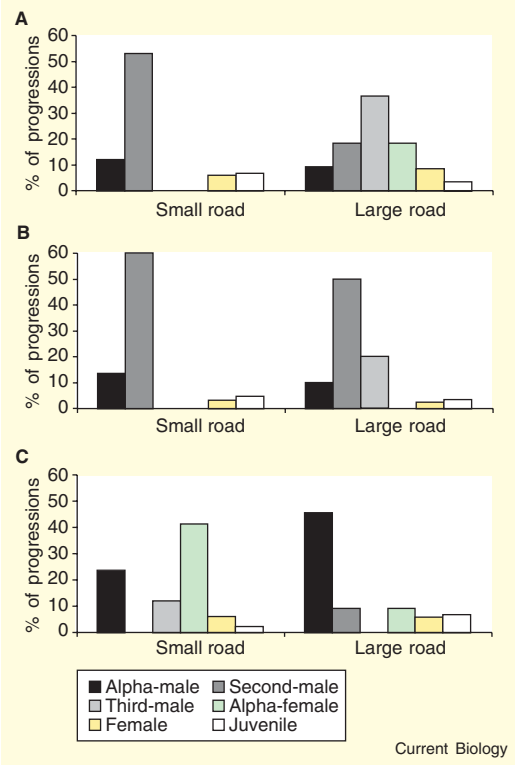

Figure 2. Summary of progression order data.

The percentages of progressions in which the three males, the alpha female and the average non-alpha female and juvenile were (A) first to cross, (B) first to scan the road, and (C) last in the progression on the two roads (infant excluded from analysis).

whereas the alpha female showed a dramatic reduction in frequency of being last; in other words when the degree of risk increased she took up a more forward position. Additionally, when the alpha male was present in mixed-group progressions containing one other adult male (N = 6, mean group size: 6.7), he was first to scan and cross in 50% of large road-crossings and last in only 33%. This suggests that his rearward position at other times was not due to fear.

Modern Bossou chimpanzees encounter predators infrequently [6], and although humans themselves are not 'predators' of these chimpanzees, we propose that road-crossing, a human-created challenge, presents a unique situation that calls for flexibility of responses by chimpanzees to variations in perceived risk.

Crossing the large road and leaving forest for open areas are potentially risky situations for chimpanzees, reflected in increased waiting time. During dangerous excursions certain positions may be more advantageous than others, depending upon age and sex [4]. Adult males, less fearful and more physically imposing than other group members, take up forward and rearward positions, with adult females and young occupying the more protected middle positions.

As hypothesised, the Bossou chimpanzees employ a phylogenetically-old mechanism to adapt to a more recent dangerous situation. However, the positioning of dominant and bolder individuals, in particular the alpha male, changed depending on both the degree of risk and number of adult males present; dominant individuals act cooperatively with a high level of flexibility to maximise group protection.

At a proximate level each individual may have preferred and recognised positions, however it is unknown whether positioning is individual- or rank-specific. Data on progression orders of other great ape populations are required, and would help shape hypotheses about emergence of this aspect of hominoid social organisation.

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Supplemental data

Supplemental data, with a video-clip of the Bossou chimpanzees crossing the large road, are available at http://www.current-biology.com/cgi/content/full/16/17/Rxxx/DC1/

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