Possible Roles of Consolation in Captive Chimpanzees (*Pan troglodytes*)

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ABSTRACT Empathy is a necessary prerequisite for the occurrence of consolation. The term "consolation" contains a hypothesis about function, which is distress alleviation. The present study aims to confirm the occurrence of consolation in captive chimpanzees via the post-conflict/matched-control method (PC-MC) and to suggest its possible roles. We collected 273 PC-MC pairs in the group of *Pan troglodytes* housed in the ZooParc de Beauval (France). We confirmed the presence of consolatory contacts (mean level of consolation, 49.5% ± 22.3% SEM) in the colony. Consolation rates were significantly higher than reconciliation levels (mean level of reconciliation, 28.9% ± 16.8% SEM). The level of consolation was greater in the absence of reconciliation than in the presence of it, suggesting that consolation might be an alternative behavior. As friendship and relatedness did not influence the occurrence of consolation, they did not seem to be the best prerequisites for this behavioral mechanism, at least in this chimpanzee colony. Affinitive contacts with third parties were significantly more frequent when the victim called attention to itself during severe aggressions by screaming. These high-pitched sounds seem to be useful in eliciting aid from conspecifics, as occurs in young humans. The occurrence of consolation reduced the likelihood of further attacks among group-members. From this perspective, both victims and consolers most likely gain potential advantages by interacting with each other when aggression is particularly severe, reconciliation is not immediate, and consequently social stress reaches high levels. Am J Phys Anthropol 129:105–111, 2006.

Most primates live in social groups. There are numerous potential benefits of sociality, such as increased protection from predators, defense of food resources, and collective rearing of offspring (van Schaik and van Hooff, 1983; Aureli, 1997). At the same time, however, sociality leads to potential competition for access to mates or limited resources (Walters and Seyfarth, 1987; Aureli, 1997; Aureli et al., 2002). As a consequence, conflicts of interest may lead to aggressive behaviors (Aureli, 1997). However, species living in social units have developed nondispersive modes of coping with conflicts and their consequences; today, we know that they have vast repertoires of peacekeeping mechanisms (Kappeler and van Schaik, 1992; Aureli et al., 2002; Preuschoft et al., 2002; Wittig and Boesch, 2003; Palagi et al., 2004a,b). De Waal and van Roosmalen (1979), during a study carried out on the Arnhem chimpanzee colony, first defined reconciliation as a tendency by former opponents to contact each other relatively shortly after a conflict and to engage in affinitive behavioral patterns, such as embracing, grooming, or kissing (postconflict reunions).

Reconciliation is not the sole postconflict affinitive interaction available for victims of aggression. Other conflict management mechanisms involving victims and third parties may take place (de Waal and van Roosmalen, 1979; de Waal and Aureli, 1996; Cords, 1997; Arnold and Whiten, 2001; Call et al., 2002; Wittig and Boesch, 2003; Cordoni et al., 2004; Palagi et al., 2004a). These triadic contacts can be distinguished as solicited/initiated (Verbeek and de Waal, 1997) and not solicited/initiated (consolation proper) by the victim. Consolation is characterized by spontaneous contacts by a third party that engages in affinitive behaviors with the victim of aggression (de Waal and van Roosmalen, 1979; de Waal and Aureli, 1996).

Up to now, consolation has been reported only for three species of apes: *Pan troglodytes* (de Waal and van Roosmalen, 1979; de Waal and Aureli, 1996; Wittig and Boesch, 2003), *Pan paniscus* (Palagi et al., 2004a), and *Gorilla gorilla gorilla* (Cordoni et al., 2004). Recent studies conducted both in the wild (Arnold and Whiten, 2001) and in captivity (Fuentes et al., 2002) did not confirm the presence of this postconflict mechanism in chimpanzees, but we have to take into account that both studies had very small sample sizes.

Empathy (the cognitive ability to perceive the distress of a conspecific) is a necessary prerequisite for the occurrence of consolation that seems to be present at high levels in humans and great apes (de Waal and Aureli, 1996; Cords, 1997; Aureli and Smucny, 2000; Preston and de Waal, 2002). The term "consolation" contains a hypothesis about function, which is distress alleviation. In fact,

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TABLE 1. Pan troglodytes *colony in ZooParc de Beauval (St. Aignan sur Cher, France)*

Subject	Sex	Class	Date of birth	Origin, arrival date
Joseph (JO)	M	Adult	1983, unk birth[1]	Cabosse, 1992
Gamin (GA)	M	Adult	1989, wild	Private, 1992
La Vieille (LA)	F	Adult	1959, captivity	Paris, 1992
Charlotte (CH)	F	Adult	1973, captivity	Paris, 1992
Micheline (MI)	F	Adult	1978, unk birth[1]	Cabosse, 1992
Baraka (BA)	F	Adult	1979, captivity	Copenhagen, 1992
Bonobo (BO)	F	Adult	1982, wild	Private, 1992
Julie (JU)	F	Adult	1982, captivity	Circus, 1992
Gypso (GY)	F	Adult	1987, captivity	Le Pal, 1993
Domi (DO)	F	Adult	1989, captivity, CH's daughter	Paris, 1992
Tsavo (TS)	M	Juvenile	1993, captivity, BA's son	Beauval
Christmas (CR)	F	Juvenile	1993, captivity, JU's daughter	Beauval
Isabelle (IS)	F	Juvenile	1994, captivity, CH's daughter	Beauval
Benji (BE)	M	Juvenile	1994, captivity, BO's son	Beauval
Melie (ME)	F	Infant	1997, captivity, GY's daughter	Beauval
Leo (LE)	M	Infant	1997, captivity, JU's son	Beauval
Makury (MA)	M	Infant	1999, captivity, BO's son	Beauval
Bazou (BZ)	M	Infant	2000, captivity, BA's son	Beauval
Rachel (RA)	F	Infant	2000, captivity, DO's daughter	Beauval

[1] Place of birth is unknown.

many authors suggest that the primary function of consolatory contacts is to calm the recipient of aggression (Aureli, 1997; Cords, 1997; van Hooff, 2001; Aureli et al., 2002; Call et al., 2002). However, other possible functions were recently proposed (Watts et al., 2000; Wittig and Boesch, 2003; Palagi et al., 2004a). These authors suggested that consolation may be a substitute for reconciliation, not only in alleviating the victim's distress but also in buffering tensions at the group level, particularly when a conflict has not yet been overcome.

The present study aims to confirm the occurrence of consolation in chimpanzees via the post-conflict/matched-control method (PC-MC) method and to suggest possible roles of postconflict affinitive interaction by testing the following predictions:

1. We expect to confirm the occurrence of consolation in chimpanzees and, as reconciliation seems to be the best option in order to buffer the tension arising from a conflict (Palagi et al., 2004a), we expect to find a higher level of reconciliation than consolation. Moreover, in order to study in depth the consolation process, we performed age/sex analyses of triadic contact interactions.
2. If consolation is an alternative behavioral mechanism in alleviating physiological distress and reducing the probability of further attacks (de Waal and Aureli, 1996; Aureli, 1997; Arnold and Barton, 2001; Call et al., 2002), its occurrence in the absence of reconciliation is expected at higher rates than in the presence of it.
3. High-pitched sounds like screams induce fast action in fellows in conspecifics of immediate physical danger. These stimuli can be used to elicit aid from nonoffspring (Preston and de Waal, 2002). In this perspective, screaming might be a good strategy for victims to call attention to themselves. Consequently, we expect that consolation is more frequent when the victim screams.
4. Since consolation has potential risks (e.g., redirection or renewed aggression), related individuals and "friends" may be more likely to accept the risk. In this view, it may be expected that consolation occurs at higher levels between kin and/or between unrelated individuals with good relationships.
5. If consolation has the function of reducing the spread of aggression within a group, it is expected that its occurrence reduces the probability of further attacks among group members.

METHODS

The study group

The group of *Pan troglodytes* under study (established in 1992) is housed in the ZooParc de Beauval (St. Aignan sur Cher, France). The colony, made up of 19 individuals, did not change in composition during the two study periods (Table 1).

The animals were housed in indoor and outdoor facilities of about 200 m^2 and 2,000 m^2, respectively. The indoor facility was formed by two large enclosures that were placed in a glass house and were equipped with trunks, lianas, ropes, and platforms so that the chimpanzees could move freely in all three dimensions. Since the animals were able to avoid each other in the indoor facility, this environment was not considered "crowded."

The group received abundant food (vegetables, fresh fruits, nuts, grains, and yogurt) at 9.00 A.M., 2.00 P.M., and 4.30 P.M.

Data collection

We collected behavioral data during a period of 7 months of observation divided into two sessions (October–January 2000/2001, and October–January 2001/2002).

Observations took place daily over a 6-hr period that spanned morning and afternoon, including feeding times after 9.00 A.M. Due to extremely low temperatures during the study periods, the animals were locked into the indoor facility, where all observations took place. As there were no sections of the indoor facility out of sight, the animals were constantly in view of the four observers (which included E.P. and G.C.). Systematic data col-

lection was preceded by a training period that lasted until the observations by the different observers matched in 95% of cases.

We collected all agonistic interactions among individuals via an all-occurrence sampling method (778 hr of observation) (Altmann, 1974). For each agonistic encounter, we recorded: 1) opponents; 2) context (i.e., circumstances in which the aggression took place, for instance, "feeding" or "prefeeding"); 3) type of conflict (unidirectional or bidirectional); 4) aggressive behavioral patterns (charging display, chasing, biting, slapping, pushing, pulling, stamping, and brusque rushing), and 5) submissive/frightened patterns and vocalization (bared teeth, urination, and screaming) (van Lawick-Goodall, 1968; van Hooff, 1973). Agonistic patterns were distinguished according to three stages of increasing intensity: stage 1, chase-fleeing; stage 2, aggressions with physical contacts (biting, slapping, pushing, pulling, stamping, or brusque rushing) without submissive/frightened patterns and vocalizations; and stage 3, aggression with physical contacts and at least one submissive/frightened pattern and vocalization as described above.

After the last aggressive pattern of any given agonistic event, we followed the victim as the focal individual for a 30-min postconflict period (PC). Matched control observations (MCs) took place during the next possible day at the same time as the original PC, on the same focal animal, in the absence of agonistic interactions during the 30 min before the beginning of the MC and when the opponents were simultaneously present in one of the two enclosures in order to ensure that they had the opportunity to interact (de Waal and Yoshihara, 1983; Kappeler and van Schaik, 1992). For both PCs and MCs, we recorded: 1) starting time; 2) type of first affinitive interaction (contact sitting, grooming, touching, play, embrace, hold out hand, kiss, mountings, and copulations); 3) the minute of first affinitive contact; 4) initiator of the affinitive contact; and 5) partner identity. A "third party" was defined as an individual other than the victim or the aggressor.

We also extracted background information on the relationship quality among individuals (excluding infants), using affinitive interactions (grooming and contact sitting) collected by scan sampling (Altmann, 1974). We carried out group scans at 5-min intervals, recording a total of 9,336 scans at the end of the two study sessions.

Data analysis

Since the behavioral data were collected during two different periods, we used MatMan 1.0 by Noldus to ascertain that social interaction matrices (grooming and contact sitting) were significantly correlated. MatMan's row-wise correlation tool was used with 10,000 permutations (to check for interindividual variability). Friedman's two-way analysis of variance (ANOVA) was used to test for differences among the three intensity stages of agonistic interactions. If a significant difference was observed among the three stages, we used the multiple-comparisons test described by Siegel and Castellan (1988, p. 180) to determine which combinations (e.g., stage 1 vs. stage 2, stage 2 vs. stage 3, or stage 1 vs. stage 3) differed significantly.

We collected 273 PC-MC pairs on adults and juveniles. Reconciliation and triadic contact analyses were carried out at the individual level; the minimum number of PC-MC pairs recorded per focal animal was six.

In the case of reconciliation for each animal, we determined the number of attracted, dispersed, and neutral pairs over all PC-MC pairs. In attracted pairs, affinitive contacts occurred earlier in the PC than in the MC (or did not occur at all in the MC), whereas in dispersed pairs, the affinitive contacts occurred earlier in the MC than in the PC (or did not occur at all in the PC). In neutral pairs, affinitive contacts occurred during the same minute in the PC and the MC, or no contact occurred in either the PC or the MC.

To avoid coding the same incident twice, for each individual we used only PC-MC pairs in which that individual was the focal animal, and entered them under its name. To evaluate individual reconciliation, we used the measure of conciliatory tendency (CCT) of Veenema et al. (1994), defined as "attracted minus dispersed pairs divided by the total number of PC-MC pairs." Individual CCTs were used to determine the group mean CCT.

In the case of consolation, for each focal individual we determined the number of attracted, dispersed, and neutral pairs (as in the case of reconciliation), but we considered all PC affinitive contacts with any third party in both PCs and MCs.

When the victim approached or invited (e.g., via extended arm) a third party before the PC affinitive contact, that contact was labeled as "solicited." Conversely, when a third party approached or invited the victim before the PC affinitive contact, that contact was labeled as "not solicited." Following a recent paper on postconflict third-party affiliation by Call et al. (2002), we calculated individual triadic contact tendencies (TCTs; defined as "attracted minus dispersed pairs divided by the total number of PC-MC pairs"), and we used them to find out the mean TCT of the group.

To analyze age/sex distribution of TCTs, we employed Kruskal-Wallis one-way analysis of variance (Siegel and Castellan, 1988).

To investigate the influence of relationship quality on consolation, for each individual we first calculated the mean value of grooming and contact sitting interactions for dyads in which that selected individual was involved. Secondly, for each individual we divided dyads involving it into three quality classes (weak, medium, and close) by the following procedure: dyads showing both grooming and contact sitting frequencies higher than the mean value of the selected individual were assigned to the close class; alternatively, dyads showing grooming or contact sitting frequencies lower than the mean value of the selected animal were assigned to the medium class; finally, dyads showing both grooming and contact sitting frequencies lower than the mean value of the selected individual were assigned to the weak class. Afterwards, we calculated the mean TCT value that each subject showed with its partners belonging to close, medium, and weak relationship quality classes. This analysis focused on 13 animals (juveniles and adults, excluding the alpha male who was never a victim). We employed Friedman's two-way analysis of variance (Siegel and Castellan, 1988) to test for differences among TCT levels according to the three relationship quality classes.

The Wilcoxon matched-pair, signed-ranks test (corrected for ties) (Siegel and Castellan, 1988) was employed to assess differences between the number of attracted and dispersed pairs. The binomial test (Siegel and Castellan, 1988) was employed to statistically compare rates of the presence/absence of consolation in the presence/absence of reconciliation.

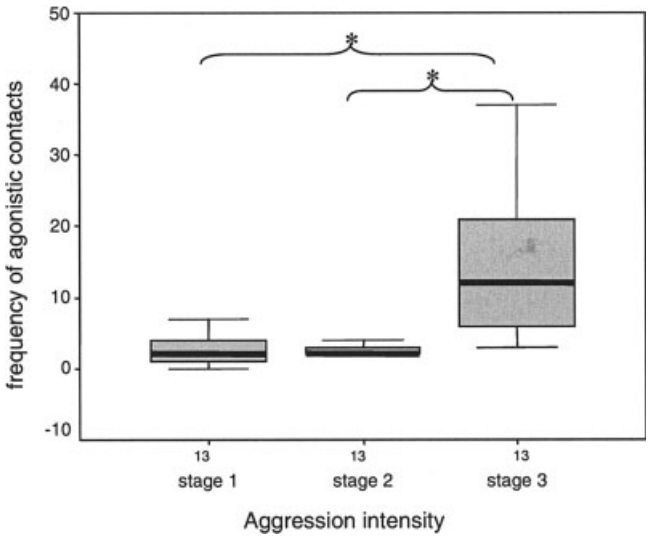

Fig. 1. Frequencies of agonistic encounters as function of aggression intensity (see Methods for definitions). Thick horizontal lines indicate medians; length of shaded boxes corresponds to interquartile range; thin horizontal lines indicate range of observed values. *$P < 0.05$.

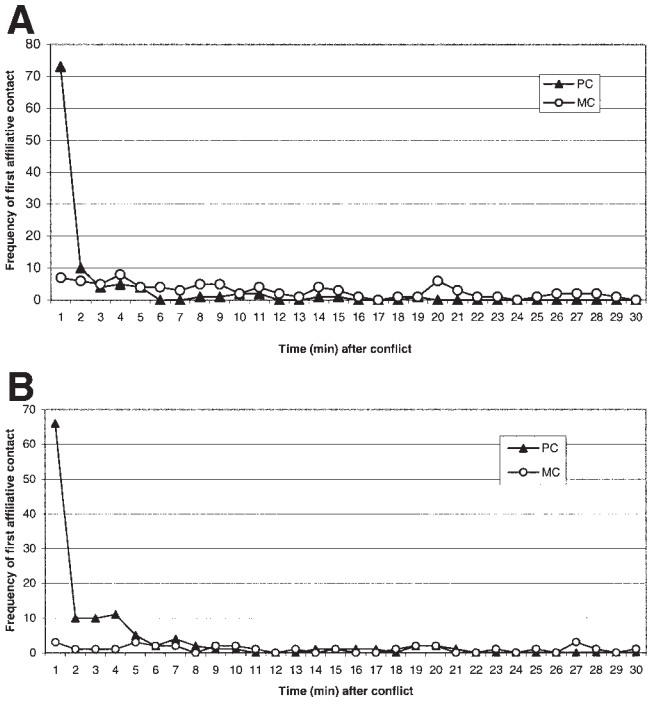

Fig. 2. **a:** Temporal distribution of first affinitive contacts in PCs (solid triangles) and MCs (open circles) for nonsolicited contacts (consolation). **b:** Temporal distribution of first affinitive contacts in PC (solid triangles) and MC (open circles) for solicited contacts.

All analyses were two-tailed, and the level of significance was set at 0.05. We made use of exact tests according to the threshold values suggested by Mundry and Fischer (1998). Statistical analyses were performed with Microsoft Excel and SPSS 9.05.

RESULTS

We compared the distributions of grooming and contact sitting interactions recorded during the two observation sessions using MatMan. The test revealed that both distributions of affinitive contacts were significantly correlated (contact sitting: Kr = 544, $tau_{rw} = 0.68$, $P < 0.001$; grooming: Kr = 549, $tau_{rw} = 0.73$, $P < 0.001$). These results allowed us to test the two data sets together.

Agonistic interactions

We found a significant difference in the frequency of the three stages of aggression (Friedman $\chi_r^2 = 17.29$, df = 2, $P < 0.001$). The multiple comparison test revealed that severe aggressions (stage 3) were more frequent than those of stage 1 and 2 (stage 1 vs. stage 3: $P < 0.01$; stage 2 vs. stage 3: $P < 0.01$) (Fig. 1).

Redirection was never observed.

Post-conflict contacts between opponents

Considering reconciliation for each of the 13 focal animals, we found a significant difference between attracted and dispersed pairs (attracted pairs > dispersed pairs: Wilcoxon's $T^+ = 0$, ties = 1, N = 13, $P < 0.01$). The mean CCT of all focal individuals was 28.87% ± 16.82% SEM.

Post-conflict contacts between the victim and a third party

Prediction I. We analyzed every possible contact between victims and third parties, and distinguished contacts as either "solicited by the victim" or consolation proper. We found a significant difference between attracted and dispersed pairs in cases of solicited contacts (attracted pairs > dispersed pairs: Wilcoxon's $T^+ = 0$, ties = 1, N = 13, $P < 0.001$). A significant difference was also found between attracted and dispersed pairs in cases of consolation (attracted pairs > dispersed pairs: Wilcoxon's $T^+ = 0$, ties = 0, N = 13, $P < 0.001$). The temporal distribution of first affinitive contacts among PC-MCs for consolation and solicited contacts is shown in Figure 2a,b, respectively.

For solicited contacts (in the absence of consolation), the mean TCT of all focal individuals was 53.0% ± 26.4% SEM (Table 2). For consolation (in the absence of solicited contacts), the mean TCT of all focal individuals was 49.5% ± 22.3% SEM (Table 2). No significant difference was found between consolation and solicited contacts (Wilcoxon's $T^+ = 41$, ties = 2, N = 13, n.s.).

A significant difference was found between individual mean CCTs and TCTs (TCTs nonsolicited contacts > CCTs: Wilcoxon's $T^+ = 68$, ties = 1, N = 13, $P < 0.05$; TCTs solicited contacts > CCTs: Wilcoxon's $T^+ = 70$, ties = 1, N = 13, $P < 0.01$).

No significant difference was found either across sex-class dyads (female-female, female-male, and male-male) (Kruskal-Wallis $\chi_r^2 = 2.746$, df = 2, n.s.) or across age-class dyads (adult-adult, adult-juvenile, and juvenile-juvenile) with regard to TCT distributions (Kruskal-Wallis $\chi_r^2 = 0.242$, df = 2, n.s.).

Prediction II. To examine the time-association of conciliatory and consolatory contacts, we counted how many times consolatory contacts followed or preceded concilia-

TABLE 2. Solicited and nonsolicited contacts (consolation): triadic contact tendency, numbers of attracted, dispersed, and neutral pairs for each focal individual[1]

	Contacts between victims and third parties							
Focal animal	A not solicited	D not solicited	N not solicited	A solicited	D solicited	N solicited	TCT not solicited	TCT solicited
Baraka	5	0	2	5	0	2	71.4%	71.4%
Benji[2]	3	2	12	11	1	12	6.0%	41.7%
Bonobo	3	0	6	6	0	5	33.3%	54.5%
Charlotte	20	1	1	18	0	0	86.4%	100.0%
Christmas[2]	3	1	3	4	0	3	28.6%	57.1%
Domi	3	0	2	7	1	2	60.0%	60.0%
Gamin	3	0	2	0	0	1	60.0%	0.0%
Gypso	16	2	2	7	1	1	70.0%	11.1%
Isabel[2]	7	0	4	6	1	4	63.6%	45.5%
Julie	10	1	5	9	0	4	56.3%	69.2%
La Vielle	5	1	3	16	1	2	44.4%	79.0%
Micheline	3	0	6	5	0	6	33.3%	45.5%
Tsavo[2]	3	0	7	8	0	7	30.0%	53.3%
Total	84	8	55	102	5	49		
Group TCT ± SEM							49.5% ± 22.3%	53.0% ± 26.4%

[1] A, attracted pairs; D, dispersed pairs; N, neutral pairs.
[2] Immature individuals.

tory contacts in PCs, obtaining the following results: when reconciliation occurred, we recorded the presence of consolation in 9.0% of cases and its absence in 91.0% of cases (binomial test, $P < 0.001$).

When reconciliation did not occur, we recorded the presence of consolation in 44.4% of cases and its absence in 55.6% (binomial test, n.s.).

Prediction III. Contacts with third parties were significantly more frequent when the victim screamed (solicited contacts: Wilcoxon's $T^+ = 8.5$, ties = 1, N = 13, $P < 0.05$; consolation: Wilcoxon's $T^+ = 14$, ties = 1, N = 13, $P < 0.05$) (Fig. 3).

Prediction IV. Considering consolation, we did not find any significant difference between attracted and dispersed pairs of related individuals (Wilcoxon's $T^+ = 7$, ties = 0, N = 9, n.s.). Conversely, a significant difference was found between attracted and dispersed pairs among unrelated animals (attracted pairs > dispersed pairs: Wilcoxon's $T^+ = 0$, ties = 0, N = 13, $P < 0.001$). The mean TCT of all focal unrelated individuals was 46.0% ± 24.78% SEM.

We found no significant difference in TCT levels according to the relationship quality class (close, medium, or weak) (Friedman $\chi_r^2 = 1.216$, df = 2, N = 13, n.s.).

Prediction V. After conflicts in which neither reconciliation nor triadic contacts occurred, the presence and the absence of further attacks within the group did not differ in their frequency (analysis at individual level: Wilcoxon's $T^+ = 0$, ties = 3, N = 6, n.s.; pooled data: binomial test, n.s.). We obtained the same finding when solicited contacts occurred (analysis at individual level: Wilcoxon's $T^+ = 10$, ties = 1, N = 9, n.s.; pooled data: binomial test, n.s.). In contrast, we found that consolation reduced the probability of further attacks among group members (analysis at individual level: Wilcoxon's $T^+ = 2$, ties = 1, N = 9, $P < 0.05$; pooled data: binomial test, $P < 0.05$) (Fig. 4).

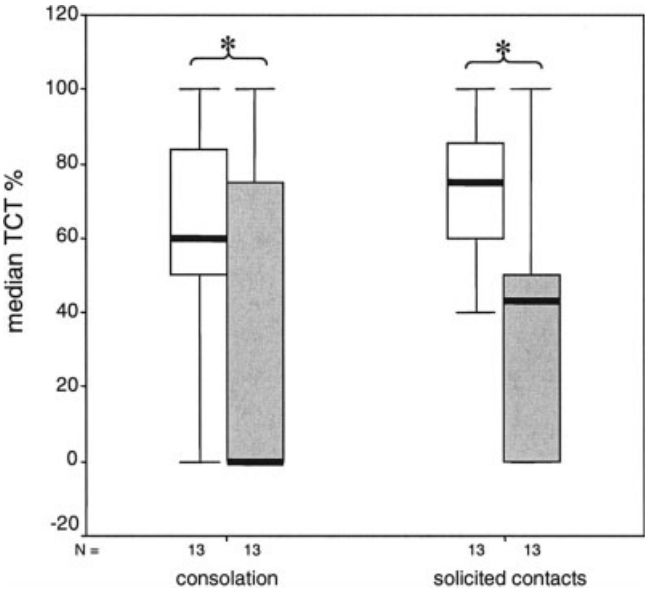

Fig. 3. TCT% in presence (open bars) or absence (shaded bars) of screaming victims. Thick horizontal lines indicate medians; length of shaded boxes corresponds to interquartile range; thin horizontal lines indicate range of observed values. *$P < 0.05$.

DISCUSSION

This paper evaluates the occurrence of consolation in the chimpanzee colony of the ZooParc de Beauval via the PC/MC method. De Waal and Aureli (1996) proposed the *social cognition hypothesis*: as chimpanzees have more highly developed cognitive abilities compared to those of monkeys, they empathize with the distress perceived by the victim. According to this hypothesis, we may assume that the prerequisite for the occurrence of consolation is empathy. The consoler arrives at an "understanding" of the victim's state through cognitive processes, and this may result in succorant actions to alleviate the distress

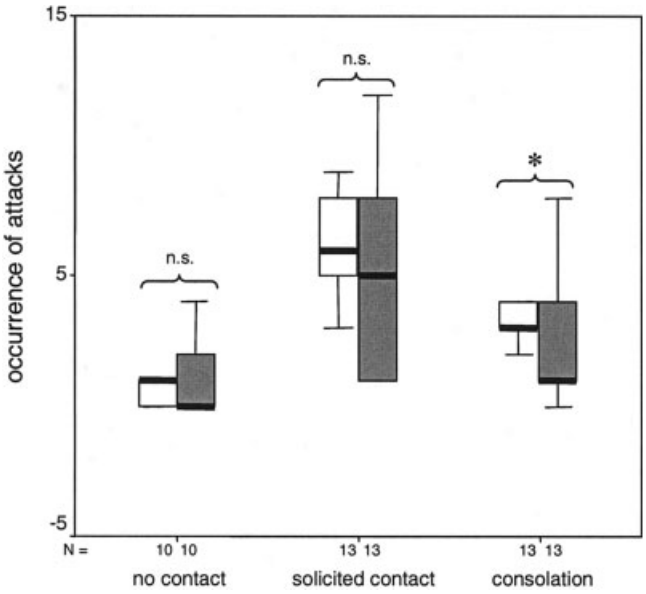

Fig. 4. Frequency of occurrence (open bars) and absence (shaded bars) of aggressions within group after no triadic contact, solicited contact, and consolation. Thick horizontal lines indicate medians; length of shaded boxes corresponds to interquartile range; thin horizontal lines indicate range of observed values. $^*P < 0.05$.

of the recipient of aggression (Preston and de Waal, 2002).

We found that the mean group TCT (solicited contacts and consolation) (Call et al., 2002) was significantly higher than the mean group CCT. Wittig and Boesch (2003) found that Taï chimpanzees seem to select the best postconflict interaction (reconciliation, third party solicited contact, consolation, renewed aggression, or redirected aggression), carefully weighing advantages and disadvantages. These authors found that consolation followed longer conflicts more than reconciliation did, and that the length of conflict increased the likelihood of further aggression as well as the level of escalation both between the opponents and within the party. Therefore, consolation was probably offered when reconciliation was either not beneficial or was too risky for conflict participants. In the chimpanzee group of the Parc de Beauval, we found that aggressive interactions were characterized by a high intensity level, and consolation was more frequent than reconciliation; thus, we can suppose that nonsolicited contacts with third parties may have been an "alternative choice" to reconciliation when further aggression was more likely to occur. When aggression is particularly severe, reconciliation is not immediate, and consequently social stress reaches high levels; both victims and third parties likely gain potential advantages by triadic contacts.

Affinitive contacts with third parties were significantly more frequent after severe aggressions during which the victim screamed. This finding attests to the success of this acoustic signal in eliciting aid from conspecifics. The high-pitched screams of a subordinate animal under attack are similar to those reported for offspring to recruit help by parents, both in young humans and chimpanzees (Einon and Potegal, 1994; Potegal and Davidson, 1997). Thus, it seems that "distress in an object evokes distress and helping in the subject, even when the two are not related" (Preston and de Waal, 2002, p. 17).

Watts et al. (2000, p. 293) stated that "consolation may even substitute for reconciliation in stress reduction and protection." A study carried out on bonobos seems to agree with this "alternative choice" hypothesis: data from the Apenheul bonobo colony showed higher levels of consolation in the absence of reconciliation (Palagi et al., 2004a). Also, our findings showed greater levels of consolation when reconciliation was not present. These results seem to confirm a role of consolation as a possible alternative mechanism.

The potential benefits of consolation obtained by the victim (stress reduction and protection against further attacks) and the risks taken by the consoler (aggression by one of the two opponents) were the two main issues on which many authors focused (Aureli, 1997; Cords, 1997; Watts et al., 2000; Aureli and Smucny, 2000). In this view, consolation can be expected to occur to a higher extent between kin and/or between animals with good relationships (de Waal and Aureli, 1996, Watts et al., 2000). Our results do not seem to confirm these assertions. Firstly, we did not find consolation among kin, whereas it was present between unrelated animals. Secondly, friendship (evaluated by contact sitting and grooming frequencies) did not affect the level of consolation. However, it must be considered that redirection is not such a common consequence when a third party approaches a victim (Watts et al., 2000; Palagi et al., 2004a), and in fact we never recorded redirection in our colony during the two observation periods. These findings seem to suggest that for consolers, the potential risk of injury is not so high. Moreover, it seems that friendship and relatedness are not the best prerequisites of the consolation process, at least in the colony under study.

We found that the occurrence of consolation reduced the likelihood of further attacks among group members. From this perspective, third parties may receive direct benefits from initiating consolatory contacts. Affinitive contacts with a third party reduce distress in the victim and may decrease social tension, preventing the diffusion of conflict throughout the entire group (Watts et al., 2000; Wittig and Boesch, 2003). For gregarious animals, mitigating and/or solving disputes is extremely important to maintain social cohesion (Aureli et al., 2002).

CONCLUSIONS

Even if reconciliation is probably the best way to minimize incompatibilities between the goals of two opponents and to repair their relationships (Kappeler and van Schaik, 1992; Aureli, 1997), consolation (an expression of high cognitive skills in humans and great apes) might provide a very important "conflict management service" (both for victims and consolers) that comes into play when reconciliation fails to occur.

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