

ORIGINAL ARTICLE

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Handedness and aggressive behavior in an Ntumu village in southern Cameroon

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Abstract Handedness in humans is possibly maintained by a frequency-dependent advantage during aggressive interactions. To contribute to relevant data related to this idea, functional handedness has been measured in a traditional ethnic group (Ntumu) from southern Cameroon, and confronted to the level of aggressive behavior. Functional handedness was measured by the hand holding the machete, an asymmetric tool used every day. Aggressive behavior was assessed by the frequency of occurrence of the traditional tribunal for solving internal conflicts. There was a low percentage of left-handers (8.1%), with no significant sex differences, although females below 50 year old displayed a significant increase of left-handedness with age. The level of aggressive behavior was low, as the traditional tribunal took place only seven times during the last five years. Results are discussed in the context of the evolution of handedness and the possible recent societal changes following European colonisation.

Key words Handedness · Weapon · Laterality · Aggression · Africa · Culture

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Introduction

Handedness and the coexistence of right- and left-handers in humans has attracted considerable interest, particularly from the medical and psychological communities (e.g. Hicks 1976; Annett 1985; Coren 1992; Corballis 1997). Despite thousands of publications devoted to this subject, some problems remain. Knowing that this trait is heritable (e.g. Levy and Nagylaki 1972; Annett 1985; McManus 1991), the main problem is to understand the significance of the handedness polymorphism. Confronted with the generally low percentage of left-handedness in all cultures, Connolly and Bishop (1992) clearly explained the problem: "If left-handedness were maladaptive, it should have been eliminated from the population whereas if it makes no difference whether one is left- or right-handed, then one would expect far less uniformity in rates of left-handedness". Recently, the frequency-dependence hypothesis has been put forward (Raymond et al. 1996): left-handers have an advantage in aggressive interactions due to their low frequency. This hypothesis is supported by the high frequency (relative to population mean) of functional left-handers among champions in interactive sports (i.e. sports in which people are in direct interaction, such as fencing, boxing, etc.) and the non-increase (relative to population mean) of left-handers among champions in non-interactive sports (athleticism, darts, etc.). If aggressive interactions are truly pivotal in explaining an advantage (and thus the persistence) of left-handedness in humans, then the frequency of left-handers and the level of societal violence should be positively correlated. Incidentally, in this context, a pertinent measurement of handedness should be related to aggressive activities, such as throwing, boxing, and all sorts of weapon manipulation.

Another problem is that most handedness studies are concerned with university students, or with particular "social" categories of modern societies [e.g. readers of a particular magazine contributing to a smell survey (Gilbert and Wysocki 1992)]. Modern societies have re-

cently changed – and are still changing – various social rules directly or indirectly related to aggressive interaction (Betzig 1986). Measures of functional handedness in traditional cultural groups are scarce in the literature (e.g. Connolly and Bishop 1992; Marchant et al. 1995; Nakamichi 1996); however such data are probably pivotal in the evaluation of current theories of evolution of handedness in humans.

The aim of this study is to contribute to such data on functional handedness in a traditional society, and to study concomitantly relevant cultural traits related to aggressive interactions. More precisely, functional handedness and aggressive interaction have been measured in a whole village from an ethnic group located in southern Cameroon, the Ntumu.

Methods

Study area

The study was performed in October 1998 in the village of Nkong Meyos, located in the Ntem valley, in the tropical rain forest of southern Cameroon. Inhabitants are from the Ntumu ethnic group, belonging to the Beti Fang branch of the Bantu linguistic group (Guthrie 1967–1970). Ntumu are horticulturalists relying on agriculture, hunting, fishing and gathering for survival. Among the few inhabitants of Nkong Meyos who are from other ethnic groups, most belong to neighboring groups (Mvae or other Beti groups) that are culturally similar. The complete demographic composition of this village in 1997 was available from Hélène Pagezy and Daniel Bley (Université de la Méditerranée, Marseille, France).

Handedness

Handedness for all individuals was assessed as the hand used to hold the machete. This functional definition is justified by three points. First, the machete is a multifunctional and omnipresent tool used daily by everyone in this community. In agriculture, the machete is used to cut trees and bushes for various purposes, and to clear the forest before plant cultivation and harvest of staple crops (banana, cassava, yam, taro, etc.) or cash crops (cacao). In gathering, many items such as firewood, medicinal barks, fruits, and so on require the machete. In hunting, trap building is based on the manufacture of several wooden parts requiring the machete, which is also used to kill trapped animals. The same is true for fishing. The machete is used also for self-defense against snakes (e.g. *Naja nigricollis*, *Bitis gabonica*, etc.) and other wild animals, for cooking (to clean, cut, peel, pick, etc.), and other tasks. Second, both sexes use the machete equally, men for all work before cultivation, hunting, fishing, and gathering, and women for cultivation, gathering, fishing, and cooking. Third, machete handedness is established early in life, at around 4–5 years old for all children, who aid in cooking, opening cacao fruits, etc. In addition, the Ntumu people regularly redesign the commercial machete for their own use, changing the length of the handle and sharpening the blade depending on which hand will be used to hold it. There are therefore left-machetes (designated *mfa'ha émong* in Ntumu language, meaning something like “reverse machete”) for left-handers and right-machetes (*mfa'ha meywom*) for right-handers. The ubiquitous use of the machete – an asymmetric tool – in everyday life makes left-handers quite conspicuous, at least among members of the same household. The list of left-handers was established by interviews. One or several people from each household (at least the head) were asked who is machete left-handed in the household. Direct observations of machete handedness were

also performed occasionally on people working in the field or in the village. These observations were all congruent with results of the interviews and will not be further mentioned. A possible switch of machete handedness was also explored during the interviews.

Aggressive interactions

Ntumu have specific rules to deal with aggressive interactions. When an aggressive threshold is reached, the traditional tribunal is called upon, which decides who is wrong (the offender) and who is right (the victim). Most oral interactions are below this threshold, while all physical fights with bare hands or weapons are above it. The traditional tribunal evaluates and eventually agrees on the request of the victim, and the offender must pay the victim. The payment is usually an amount of money or an animal (a hen, goat, or sheep), depending on the case. Sometimes the headman later gives the offender the same amount the offender has paid to the victim, to stop the development of possible anger. Interviews were conducted to establish how frequently a traditional tribunal operates in this village. In addition, one measure of level of societal violence proposed by Chagnon (1988) was investigated: the number and kinds of close kinsmen each person has lost through violence. Only people 40 years old or older were considered. Kinsmen were all possible members belonging to a household.

Statistics

The increase or decrease of the frequency of left-handers in advancing age classes was tested (two-sided tests) according to Crawley (1993), using a logistic regression with the GLIM computer package (Baker 1987). A Fisher exact test on contingency tables was performed using STRUC software (Raymond and Rousset 1995).

Results

Handedness

Twenty left-handers were identified in the village of Nkong Meyos, among 27 households, excluding all people below 4 years old. No switch of handedness of any individual is known. This gives an overall frequency of 8.13% (20/246) left-handers, with no significant difference between men and women (7.1%, or 8/113 for women and 9.0%, or 12/133 for men, 2×2 Fisher exact test, $P>0.60$). No variation of left-handedness was apparent across the 27 households of the village (27×2 Fisher exact test, $P>0.6$).

No variation of the frequency of left-handers with age was apparent, as the change in deviance introduced by the age variable was not significant for the whole data set ($\chi^2=0.52$, $df=1$, $P=0.47$). When each sex was considered separately, no variation was apparent in males ($\chi^2=0.23$, $df=1$, $P=0.63$; slope=-0.008), although a marginally non-significant trend existed in females ($\chi^2=2.75$, $df=1$, $P=0.097$, slope=0.031). When the data set was limited to individuals under 50 years old (i.e. 86% of the sample size), there was a non-significant negative trend for males ($\chi^2=0.80$, $df=1$, $P=0.36$, slope=-0.026) and a significant and positive trend for females ($\chi^2=4.65$, $df=1$, $P=0.031$, slope=0.061).

Aggressive interactions

Interviews were conducted to establish how frequently the traditional tribunal takes place. Each headman of a household ($n=11$ households) gave the same answer: during the last 5 years, the traditional tribunal operated on seven occasions to regulate conflicts. Only two of these conflicts were actual fights (only one resulted in serious wounds to one of the fighters); the others were verbal insults (three times) or witchcraft activities (two times). Interviews were also performed to determine how frequently death occurs as a result of a fight. All headmen provided the same answer: as far as they could recall, in the whole Ntem valley (thus well beyond the village of Nkong Meyos), only two such deaths are known. One involved a fight between two brothers, the other a fight between a husband and his wife. In all interviews, headmen were very explicit about the importance of solving and tempering all incipient conflicts.

Discussion

About 8% of the Ntumu ethnic group from southern Cameroon have been found to be left-handed for machete manipulation. Unfortunately, to our knowledge, there are no other data published for machete handedness in any human culture. Other data on functional handedness for a trait related to weapon manipulation are scarce in continental Africa (i.e. excluding all data based on index measurements or writing laterality). In Nigeria (unknown ethnic group), ambidextrous and left-handed throwers account for 14.5% of the male population ($n=131$) and 17.6% of the female population ($n=119$) (Perelle and Ehrman 1994). There are indications (Marchant et al. 1995), based on a low sample size, that ambidextrous and left-handers for tool use account for at least 10% and 22% in Botswana (G/wi ethnic group, $n=41$) and Namibia (Himba ethnic group, $n=37$), respectively. Unfortunately, we are not aware of other published data of functional handedness for a trait related to weapon manipulation concerning continental Africa. It can be tentatively concluded, from this modest data set, that the percentage of left-handers found in the Ntumu is low when compared to other continental Africa groups.

The level of aggressive interaction found in this Ntumu village is rather low, as the number of kin each person has lost through violence is far lower than 0.1%. This could be compared to e.g. the Yanomamö, where "nearly 70% of all individuals (males and females) age 40 or older have lost at least one close genetic kin due to violence" (Chagnon 1988) [interestingly, ambidextrous and left-handers for tool use account for at least 23% of this ethnic group (Marchant et al. 1995)]. According to this author, the Yanomamö level of societal violence is rather typical of most tribal societies before their first contact with colonial nation-states. It is known that wars among the Ntumu were common before the end of the

19th century, when Christian missionaries began to be active in the area (Laburthe-Tolra 1981). This suggests that the low level of aggression found in this Ntumu village is probably of recent origin.

The relatively low level of left-handedness, found concomitantly with a low level of aggressive interaction, is consistent with the frequency-dependence hypothesis. However, if a recent – and drastic – decrease in the level of aggression is highly probable, it is not known if the same is true for the frequency of left-handers. A decrease of left-handedness could be suspected if the fragmentary data from other African groups reflect a general situation found before the influence of missionaries and western colonizers. The present frequency of left-handers in the Ntumu village could represent either a stable polymorphism (i.e. reflecting a balance between their frequency-dependence advantage in aggressive interaction and the unidentified cost associated with left-handedness), or a transient equilibrium (i.e. the frequency of left-handers will continue to decrease until a stable value is reached, possibly zero if aggressive interactions are scarce). The tendency for the increase of the frequency of left-handed females with age (significant below 50 years old) is consistent with a higher proportion of left-handedness in the recent past. However, this trend is not found in the male population. This could be explained if left-handed males experience a substantial survival cost, as described in some modern societies (e.g. Halpern and Coren 1988; Coren and Halpern 1991; Aggleton et al. 1993). Why the survival cost of left-handed Ntumu would be higher in males than in females is unknown, although it should be noted that this survival cost is poorly known in modern societies as well, as shown by the existing controversy on this subject (e.g. Harris 1993; Ellis et al. 1998).

The results found in this relatively small sample of Ntumu people are to be taken cautiously, and they indicate that further data, particularly a follow up in time, would be invaluable to study directly a possible change of left-handedness frequency after a recent and dramatic reduction of the level of societal violence.

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