

# CRYING IN !KUNG SAN INFANTS: A TEST OF THE CULTURAL SPECIFICITY HYPOTHESIS

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Crying is the earliest and most compelling of infant signals. In developmental studies, the most robust feature of infant crying has been an early pattern characterized by increased crying in the first few weeks, a peak during the second month and a decline during the third and fourth months (Brazelton 1962, Rebelsky and Black 1972, Emde *et al.* 1976, Hunziker and Barr 1986, Barr 1990a). There is more crying in the first quarter than in any other quarter of the first year (Bell and Ainsworth 1972, Roe 1975, Emde *et al.* 1976, Snow *et al.* 1980, Hubbard and van IJzendoorn 1987, St. James-Roberts 1989), which suggests that this phenomenon is specific to early infancy. In addition, the early peak coincides with a tendency for crying to cluster in the late afternoon and evening hours (Brazelton 1962, Bernal 1972, Hunziker and Barr 1986, Barr *et al.* 1989, St. James-Roberts 1989). Increased first-quarter crying pertains only to over-all duration per day, however; frequency of crying tends not to be age-related (Bell and Ainsworth 1972, Landau 1982, Hubbard and van IJzendoorn 1987). Because there is considerable variability between infants, the same pattern will not always be seen (Barr 1990a), but with few exceptions (Wolff 1969) it has been replicated consistently for groups of

infants using a wide variety of recording methods (Barr 1990a).

This consistency suggests that the early crying peak is 'normal', and may be a behavior universal to infancy in the human species. The fact that it occurs despite considerable variation in caretaking style seems to support this interpretation (Brazelton 1962, Emde *et al.* 1976). Furthermore, it is consistent with speculations that crying serves an important survival function in early infancy. Bell and Ainsworth (1972) argued that 'a basic assumption' of their approach is that 'species-specific behaviors, including attachment behaviors such as crying, have become part of the genetically programmed repertoire of the species through performing a significant survival-promoting function for individuals, populations, and/or species . . . and continue to perform such a function in the present environments occupied by the species' (p. 1186). Brazelton (1962) argued that a certain amount of crying is normal in our culture, and 'even necessary to a normal infant in the first few months . . .' (p. 580). While not claiming specificity for the pattern of the early crying peak, these arguments suggest that this behavioral pattern has important implications for our understanding of the species.

Despite the apparent consistency, there is evidence that this early crying pattern may be culture- rather than species-specific. First, virtually all of the studies describing it have been carried out in Western industrialized societies, leaving open the possibility that more radical differences in caretaking styles could affect the pattern. Second, many studies report effects of caretaking style on crying (e.g. Caudill and Weinstein 1969, Sander *et al.* 1970, Bell and Ainsworth 1972, Crockenberg and Smith 1982, Landau 1982, Thoman *et al.* 1983, Hubbard and van IJzendoorn 1987, Barr and Elias 1988). However, those reported have been limited to changes in the amount rather than the pattern of crying (Barr 1990a). Third, anecdotal reports suggest that infants in less industrialized societies cry and fret less (Mead 1935, Brazelton *et al.* 1969, Konner 1972, Kennell 1980). For example Brazelton and colleagues reported that 'the Zinacantecos maintained quiet, alert states for long periods, with slow, smooth transitions from one state to another. We recorded none of the deep sleep, intensive crying, or intense sucking states observed in the American controls'. Nonetheless, none of these reports indicate whether these 'quiet' infants manifest an early crying peak.

The fourth, and perhaps strongest, line of evidence for cultural specificity is a randomized controlled trial in which increased carrying and holding, beginning at four weeks of age, changed the pattern of crying and fussing by eliminating the six-week peak (Hunziker and Barr 1986). These findings were the first to suggest that the pattern, as well as the amount, of early crying may be amenable to differences in caretaking. Carrying and holding are virtually constant in hunter-gatherer societies (e.g. Konner 1972, Lozoff and Brittenham 1979). In effect, Hunziker and Barr's study increased one aspect of the caretaking of the North American mothers above that characteristic of their society, and in the direction of that typical of many non-industrial societies. This suggests that if increased carrying became a standard part of the caretaking routine in industrialized societies, the crying pattern might be altered. However, since the intervention

only commenced at four weeks of age, there may still have been the early peak, albeit with lower over-all levels of crying (Barr 1990b).

To determine whether this early peak in crying is specific to infant care practices typical of Western industrialized societies, we analysed the crying and fretting behavior of infants of the !Kung San, a hunter-gatherer society living in the semi-arid Kalahari desert region of north-western Botswana (see Lee and DeVore 1976, Lee 1979). !Kung San infant care differs substantially from Western practices (Konner 1972, 1976, 1977) and includes continuous holding and carrying (greater than 80 per cent of the time during daytime observations) (Konner 1976), frequent or 'continuous' feeding (averaging four times/hour) (Konner and Worthman 1980), upright posture in a sling or kaross, and universal and immediate caregiver response to infant signals (greater than 92 per cent response within 15 seconds to infant cry/fret signals) (Barr *et al.* 1987). Extrapolating from North American and European studies, these features are likely to affect infant crying, probably by predisposing to 'quieter' infants (Wolff 1969, Sander *et al.* 1970, Bell and Ainsworth 1972, Konner and Thoman 1972, Gregg *et al.* 1976, Hunziker and Barr 1986, Hubbard and van IJzendoorn 1987, Barr and Elias 1988, Barr 1990b).

The aims of the present analyses were (1) to determine whether there was evidence of an early peak pattern in the amount of crying and fretting behavior of !Kung San infants, and (2) to characterize its 'intensity' in the context of this 'responsive' caregiving. In addition, relevant data from studies in Western societies are compared to illustrate similarities and differences between amounts of crying.

#### *Subjects and method*

The analyses are based on behavioral observations of !Kung San infant-caregiver interaction during a 20-month period between 1969 and 1971 and a six-month period in 1975. All available infants within the area of northwestern Botswana were studied by the Harvard Kalahari Research Project (see Lee 1979). 46 infants were observed a total of 68

times, at ages ranging from one to 99 weeks. Of the 46 infants, 30 were observed once, 12 twice, two three times and two four times. An 'observation' of one infant at a particular age typically consisted of six 15-minute sessions. A session was begun only when the infant was in good health, awake, not in the sling at the mother's side, not nursing, and within 15 feet of the mother. All six sessions occurred within a one-week period, were randomly distributed over the waking hours, and occurred in the general village-camp environment rather than on a gathering expedition. Of the 68 observations, 60 included six sessions, but three included five, two included four, one included three and two included two sessions each. Female infants were observed in 30 of the 68 observations and, on average, at older ages than boys (mean 46.6 vs. 33.2 weeks). The total consisted of 390 15-minute sessions (97.5 hours).

All observations were carried out by a single observer (M.J.K.) using a timed five-second interval recording technique with the infant as the focus. Codable behaviors were recorded on a lined form, each line representing five seconds. Time was marked by an electronic beeper which emitted a signal through an earpiece audible only to the observer. All behavioral codes that occurred within each successive five-second interval were indicated throughout the 15-minute session. The coding system contained over 100 codes referring to behavioral units of minimal inference, derived in part from the work of Blurton Jones (1972), Tulkin and Kagan (1972) and others.

In this paper, we report on fret, defined as 'nonrhythmic whining vocalization associated with fret face or pucker face'; cry, defined similarly except that it was repeated 'rhythmic' whining with duration; and cry/fret, a composite variable in which the behavior was considered to be present in any interval if cry and/or fret occurred.

Before starting the observations, the observer had established reliability with other observers using a similar coding scheme. However, reliability was not further assessed in the field. Although not ideal, this lack of reliability measures should be balanced against the uniqueness

of the data, the difficulty of collecting any data at all in remote locations, the concreteness of the codes used, and the demonstrated ability of the observer and others, using essentially similar codes, to establish reliability (Elias *et al.* 1986, Barr and Elias 1988).

#### *Data analysis*

The observations at 68 age-points were used as the units of analysis. Measures of duration (minutes/waking hour) and frequency (events/waking hour) were derived for each observation for cry, fret, and cry/fret behaviors. The duration measure was the product of the number of intervals in which the behavior occurred, multiplied by five seconds. Since the behavior may not have lasted throughout the interval in which it occurred, this measure will overestimate the actual duration. 'Events' is a term used to describe one or more consecutive individual cry or fret expiratory-inspiratory cycles (Barr 1990b). In this study, cry and/or fret events were approximated by counting one or more consecutive five-second intervals as an event. Thus, an event started in an interval if the behavior was not present in the previous five-second interval, and continued as long as the behavior was observed in each of the successive intervals. The frequency measure refers to the number of intervals in which a behavioral event started per hour of observation.

To investigate the pattern of crying and fretting behavior across different ages, observations were assigned a priori to seven age categories according to infant age in weeks at the time of observation: four weeks or less (N=6 observations), five to eight (N=8), nine to 13 (N=7), 14 to 26 (N=10) 27 to 52 (N=12), 53 to 78 (N=17), and 79 to 99 (N=8). The greater number of observations in younger infants permitted smaller age categories in the first quarter-year to detect a peak pattern, if present. However, the age category boundaries were defined as fractions or multiples of quarters of a year, both to prevent *post hoc* 'fitting' of the age categories to the data and to facilitate comparison with other reports from Western societies (Barr 1990a). Of

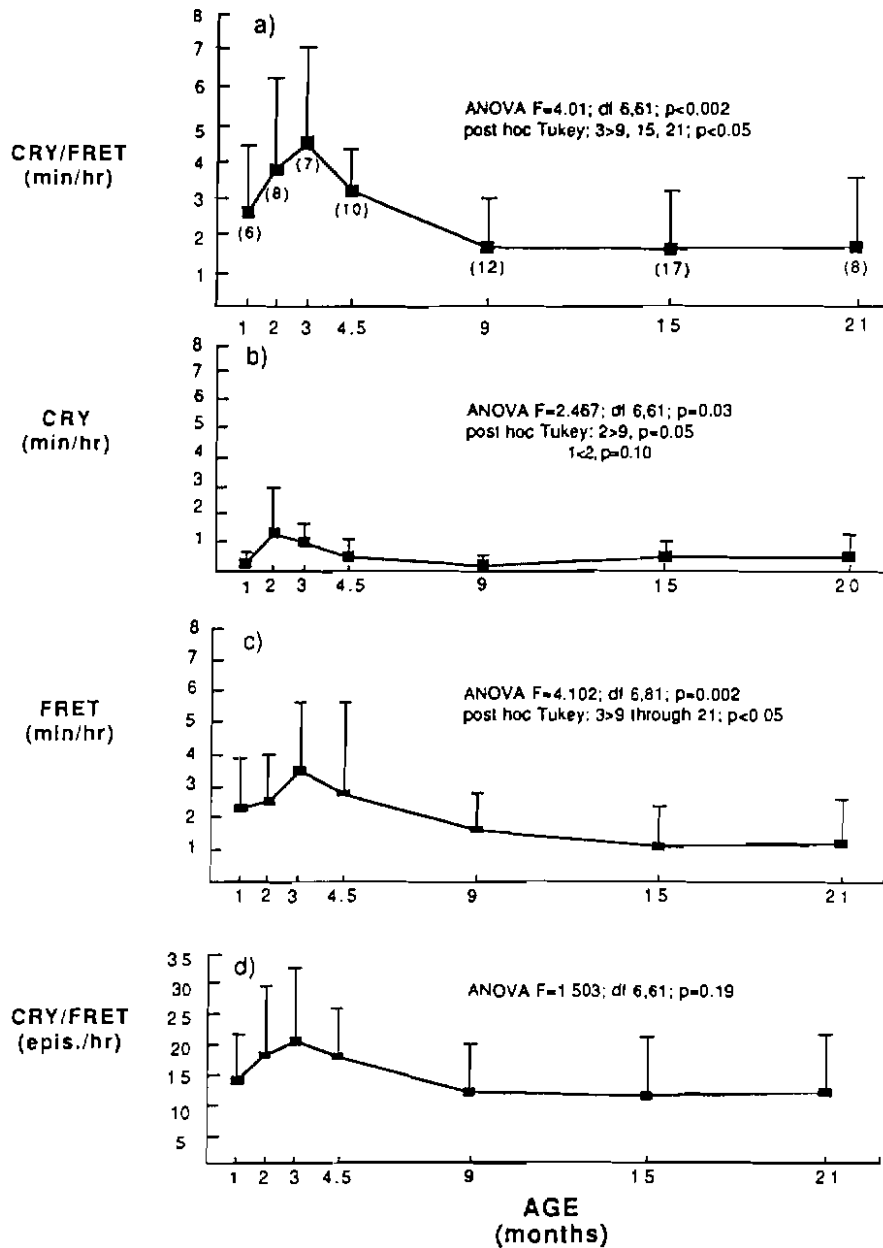


Fig. 1. Duration and frequency of crying behavior in !Kung San infants as function of age: (a) duration for combined cry/fret codes; (b) and (c) cry and fret durations; (d) frequency of cry/fret episodes. Data points represent mean values (+ 1SD) at each age. Infants observed at each point indicated in brackets in (a). Note differences in scale and measure between a,b,c and d.

the 46 infants, only four contributed more than one observation to any one age category. Change across ages was assessed by one-way ANOVA, with *post hoc* Tukey tests used to locate significant differences between age categories.

To characterize the intensity of crying

typical of !Kung San infants, two descriptive indices were derived: (1) frequency of long (30 second or more) and short (five seconds or less) cry/fret events; and (2) percentage of cry/fret duration which is cry compared with fret. Because there was little age-related

change, these descriptions are presented in three age brackets: first quarter-year ( $N=21$ ), last three-quarters of first year ( $N=22$ ), and second year of age ( $N=25$ ).

To illustrate similarities and differences in amounts of crying, measures of duration and frequency from two closely analogous studies in Western settings are compared with the !Kung San data. The Hubbard and van IJzendoorn (1987) study summarized quarter-yearly results from direct observations of Dutch infants during waking hours from the first to the third quarter of the first year. It differs from the present study in using more finely accurate event recorders and audiorecordings, in not distinguishing crying and fretting, and in requiring a shorter quiet time (two to four seconds) to distinguish between two events. These differences should increase frequency and decrease recorded duration relative to the !Kung San data. The Barr and Elias (1988) study used an identical coding and observational system, but differed in reporting observations made only in the second and fourth months of life, and only in terms of event frequencies.

### Results

The duration of cry/fret behavior by age category is illustrated in Figure 1a. Mean cry/fret behavior tended to increase from 2.6min/hr in the first month to a peak in the third month (4.5min/hr), followed by a decline until six months, after which it remained stable at just under 2mins/hr. The one-way ANOVA by age was significant ( $F(6,61)=4.01$ ,  $p<0.002$ ); *post hoc* Tukey tests revealed that cry/fret duration in month three was significantly higher than at any time after six months (all  $p<0.05$ ).

Similar patterns were seen when cry duration (Fig. 1b) and fret duration (Fig. 1c) were considered separately ( $F(6,61)=2.47$ ,  $p=0.03$ ;  $F(6,61)=4.10$ ,  $p=0.002$ , respectively). For cry duration, the peak occurred at two months (1.3mins/hr), but was significantly higher than other crying levels only during the last half of the first year ( $p<0.05$ ). The peak for fret duration occurred at three months (3.5mins/hr), and was significantly higher than the duration at any time after six months (all  $p<0.05$ ).

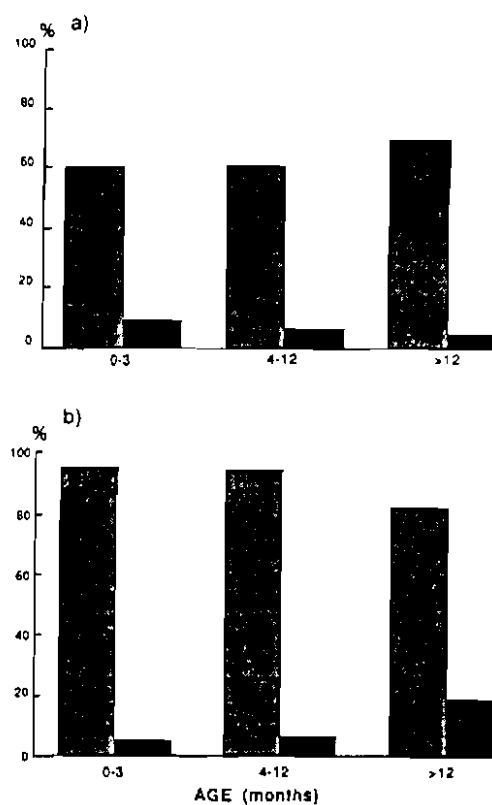


Fig. 2. Intensity of crying in !Kung San infants as function of age: (a) grey and black bars illustrate percentage of cries that are short ( $\leq 5s$ ) or long ( $\geq 30s$ ), respectively; (b) grey and black bars illustrate percentage of cry/fret episodes that include frets or cries, respectively.

Consistent with studies from Western industrial societies, the pattern was similar, but attenuated, for the measure of cry/fret frequency (Fig. 1d). The highest frequency occurred at three months (20.5episodes/hr), but there was no significant over-all difference by age periods ( $F(6,61)=1.50$ ,  $p=0.19$ ).

The characterizations of 'intensity' of !Kung San crying are illustrated in Figure 2. At all ages, cry/fret events lasting five seconds or less predominate and those lasting longer than 30 seconds are infrequent (Fig. 2a). Short cry/fret events constitute 60, 61 and 69 per cent of all such events for the three age groups, respectively. Similarly, the proportion of over-all crying duration represented by cry compared with fuss tends to be small (Fig. 2b). During the time of peak crying

TABLE 1  
Amount of crying behavior by age of !Kung San<sup>1</sup>, Dutch<sup>2</sup> and USA<sup>3</sup> infants

	Age (months)					
	0-3		4-6		7-9+	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Frequency (events/hr)						
!Kung San	17.8	(10.4)	17.9	(7.8)	11.8	(7.8)
Dutch	16	(6.0)	16	(8.0)	15	(6.5)
USA	15.8	(10.6)	16.6	(8.6)	—	—
Duration (mins/waking hr)						
!Kung San	3.7	(2.3)	3.2	(1.1)	1.7	(1.3)
Dutch	7.2	(5.1)	5.0	(3.7)	3.2	(1.8)

<sup>1</sup>Sample from present study: N = 21, 10 and 12 for each age group, respectively; last group includes infants six to 12 months of age. Values are for combined cry and fret.

<sup>2</sup>Sample of Hubbard and van IJzendoorn (1987) includes same 25 infants visited every three weeks. Values collapsed within quarter-years. Measures describe 'distress' signals: no distinction made between crying and fretting. Of four frequency definitions reported, one used here is closest to !Kung San measure, i.e. one-second minimum duration separated by pause of at least four seconds. Of four duration definitions, one used here is that reporting longest durations, since if anything, !Kung San duration measures are overestimates.

<sup>3</sup>Sample of Barr and Elias (1988) includes same 16 infants visited at two and four months. Frequency measures are for combined cry and fret.

(nought to three months), cry represented 5 per cent of over-all cry/fret duration; by the second year it represented 18 per cent. Consequently, although the cry/fret events are frequent (17.8, 14.6 and 11.4 events/hr, respectively), they have the character of being predominantly short and fretful, rather than long cries.

The amounts of crying and fretting are presented in Table 1; the values suggest that there is little difference between !Kung San, Dutch and USA samples with regard to event frequency. By contrast, duration measures in the !Kung San sample are approximately one-half those found in the Dutch sample. To illustrate the similarities and differences, we can estimate the population means for Dutch infants by calculating the 95 per cent confidence intervals and see whether the sample means for !Kung San infants are included. For crying duration, the intervals were 5.1 to 9.3, 3.5 to 6.5 and 2.5 to 3.9 mins/hr at nought to three, four to six and seven to nine months, respectively. The duration means for the !Kung San sample fell below these limits at each age, so it is unlikely that their mean values could reasonably be obtained in samples of Dutch infants. By contrast, the means for the !Kung San sample's frequency measures fell within the 95 per

cent confidence intervals for the Dutch population at nought to three months (13.5 to 18.5 events/hr) and at four to six months (12.7 to 19.3 events/hr), and were lower only at seven to nine months (12.3 to 17.7 events/hr).

### Discussion

Studies in Western industrialized societies consistently report a peak in crying duration within the first three months, and more crying during the first three months than in later infancy (Barr 1990a). These results for !Kung San infants indicate that their crying duration is significantly greater in the first quarter of the year than later. In addition, they strongly suggest that !Kung San crying shows a peak within the first three months. The between-month differences within the first quarter did not reach statistical significance, probably because of the typically wide variability between infants (Brazelton 1962, Rebelsky and Black 1972, Hunziker and Barr 1986, Barr 1990a) and the relatively small samples in each group. The small sample sizes also preclude firm conclusions about the relative timing of peak crying. Thus it is unclear whether the !Kung San peak at three months is truly 'later' than the two-month peak more typical in Western

studies (Brazelton 1962, Rebelsky and Black 1972, Hunziker and Barr 1986), or whether the fretting peak is truly later than the crying peak within the !Kung San sample.

As in Western samples, the !Kung San results also share the relative specificity of the pattern for measures of duration rather than frequency (Barr 1990b). If anything, the suggestion of higher first-quarter frequency is more apparent in the !Kung San data than in the most analogous Western studies, in which no difference is suggested (Bell and Ainsworth 1972, Hubbard and van IJzendoorn 1987). This may be because over 60 per cent of the crying events are short (less than 5 seconds) in the King San infants, which tends to make the duration and frequency measures equivalent. Thus despite some differences in detail, the over-all pattern for the group is remarkably similar to that reported for infants in Western societies.

The measures of crying 'intensity' were derived to give some indication of the quality as well as the pattern of crying during early infancy. These measures are of interest because crying can elicit both altruistic, nurturing responses (relieving the infant's distress) and egoistic, non-nurturing responses (relieving the listener's distress) as a function of intensity (Murray 1979). Both ethnographic (Konner 1972, 1977) and systematic descriptions (Barr *et al.* 1987) indicate that caretaker responsivity in the !Kung San is multisensory, quick, virtually universal (over 90 per cent of the time) and positive in tone (Barr 1990b). In contrast, rates of deliberate non-response in Western samples approach 40 to 50 per cent (Bell and Ainsworth 1972, Hubbard and van IJzendoorn 1987). It has been argued that the characteristic responsivity and other features of !Kung San caregiving would be associated with short, though probably frequent, crying bouts (Barr 1990b). Consistent with that picture, the intensity measures suggest that !Kung San infant crying is predominantly low-intensity fretting, with very few prolonged cry/fret events. It is possible that such low-intensity crying may be less likely to provoke the aversive, egoistic responses reported for parents in

Western societies (Weston 1968, Murray 1979, Frodi 1981).

It is tempting, though potentially misleading, to ask whether the amount of crying observed in !Kung San infants approximates that seen in Western infants. In the absence of comparable groups, sampling, observation techniques, observers and measures, there is considerable risk that superficial similarities or differences may be spurious. However, unless these methodological differences resulted in serious relative overestimation of Western crying, the comparisons of data from !Kung San, Dutch, and USA samples suggest that crying frequencies are at least within similar ranges. In contrast, and despite the likelihood of relative overestimation of cry duration in !Kung San infants, the duration measures suggest that they may cry approximately half as much as Dutch infants.

These quantitative measures may have underestimated the amount of crying in both the !Kung San and Western samples because the observations occurred during the daytime. For Western infants, the typical evening clustering (1800 to 2400 hours) accounts for 40 per cent of the total (Barr *et al.* 1989, St. James-Roberts 1989). Whether such evening clustering occurs in !Kung San infants is unknown, and it is also possible that they cry more at night. Ethnographic descriptions of this population (Konner and Worthman 1980) indicate more frequent awakenings and less prolonged sleeping bouts, features also seen in systematic observations of co-sleeping and frequently breast-feeding Western infants (Super and Harkness 1977, Elias *et al.* 1986). If these awakenings are accompanied by crying, then over-all crying per day in !Kung San infants may be greater and more similar to that of Western infants, except that there would be relatively less during the day and more during the night.

Consequently, while the early peak and frequency of daytime crying are similar, the picture for !Kung San infants may differ substantially from that for Western infants. During the daytime, !Kung San crying appears to be less over-all, and predominantly short and fretful compared with the prolonged crying

bouts thought to be typical of Western infants (Barr 1990b). The peak pattern in the !Kung San infants further increases the evidence that caregiving specifically affects duration of crying. The increased carrying in Hunziker and Barr's study (1986) substantially reduced over-all duration (per 24 hours) but did not affect the frequency of crying and fussing. However, it is possible that caregiving differences may also affect the distribution of crying within the day. Western infants changed from breast- to formula-milk cried and fussed the same amount over-all, but significantly less in the evening, than infants consistently breast-fed since birth (Barr *et al.* 1989). It remains unclear whether !Kung San caregiving simply reduces the duration of daytime crying or redistributes it between day and night-time.

By widening the range of caretaking contexts in which the early crying peak is discernible, the !Kung San data support the concept that this pattern represents a behavior universal to the human species, in the sense that it applies to all populations, if not all individuals, within the species (Konner 1989). Previous authors have interpreted the early peak as a manifestation of a 'biobehavioral shift', in which early crying is understood as a relatively undifferentiated reflection of physiological state ('expressive' crying) compared with later, more intentional ('communicative') crying (*e.g.* Bell and Ainsworth 1972, Emde *et al.* 1976,

Gekoski *et al.* 1983, Franco 1984, Thompson *et al.* 1988). The co-existence of this peak with discontinuities in other presumably biologically-based behavioral rhythms, and its robustness in the face of variations in maternal responsiveness have been taken as support for this interpretation (Parmelee and Stern 1972, Emde *et al.* 1976, Precht 1984, Hopkins and Palthe 1987, Wolff 1987). The presence of the peak in the !Kung San caregiving context lends weight to this interpretation and argues against the cultural specificity hypothesis as an explanation of its presence in Western societies.

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#### SUMMARY

The pattern of crying and fretting behavior during the first two years is described for 46 !Kung San infants from a hunter-gatherer society in northwestern Botswana. Despite markedly different caretaking practices predisposing to quieter infants, crying and fretting were significantly greater during the first three months, and a peak pattern was present. Measurement of crying 'intensity' indicated that it was predominantly short and fretful. The results support the concept that the early peak pattern is not specific to infants in western industrialized societies, and may represent a behavior universal to the human species. The caretaking differences between societies primarily appear to affect crying duration rather than its frequency and pattern in early infancy.

#### RÉSUMÉ

*Les pleurs chez les nourrissons de Kung San: un test pour une hypothèse de spécificité clinique*  
Le comportement de cris et d'agitations durant les deux premières années est décrit chez 46 nourrissons Kung San venant d'un groupe de chasse-cueillette dans le nord-ouest du Botswana. En dépit des pratiques de prise en charge très différentes, devant permettre des nourrissons plus calmes, les pleurs et l'agitation sont significativement plus marqués durant les trois premiers mois et un groupement symptomatique particulièrement fréquent peut être décrit. La mesure de l'intensité des pleurs indique qu'ils sont d'une façon prédominante courts et associés à l'agitation. Ces résultats favorisent la notion que ce groupement symptomatique précoce particulier n'est pas spécifique aux nourrissons des sociétés occidentales industrialisées et peut traduire un comportement universel dans l'espèce humaine. Les différences de prise en charge entre les sociétés semblent affecter de façon prédominante la durée des pleurs plutôt que leur fréquence et leur allure durant la première enfance.



## ZUSAMMENFASSUNG

*Schreien bei !Kung San Kindern: ein Test zur Hypothese der klinischen Spezifität*

Bei 46 !Kung San Kindern eines Volksstammes der Jäger und Sammler im nordwestlichen Botswana werden die Verhaltensmuster beim Schreien und bei Erregung in den ersten zwei Lebensjahren beschrieben. Trotz unterschiedlicher Betreuungsweisen mit dem Ziel, die Kinder ruhiger zu bekommen, waren Schreien und Unruhe in den ersten drei Monaten signifikant vermehrt, und es fand sich ein Peak Pattern. Messungen der 'Intensität' des Schreiens zeigten, daß es in der Regel kurz und gereizt war. Die Ergebnisse stützen die Hypothese, daß das frühe Peak Pattern nicht für Kinder der westlichen industrialisierten Gesellschaft spezifisch ist, es ist vielleicht ein für die Spezies Mensch typisches Verhalten. Die unterschiedlichen Betreuungsweisen in den Gesellschaften scheinen im frühen Kindesalter primär die Dauer des Schreiens zu beeinflussen, nicht aber die Häufigkeit und das Pattern.

## RESUMEN

*El llanto en niños con !Kung San: un test de la hipótesis de la especificidad clínica*

Se describe el tipo de llanto y de comportamiento irritable durante los primeros dos años de edad en 46 niños !Kung San pertenecientes a una sociedad cazadora recolectora del noroeste de Botswana. A pesar de unos cuidados marcadamente diferentes encaminados a aquietar a los niños, el llanto y la irritabilidad eran significativamente mayores durante los primeros tres meses, presentando un modelo en pico. La medición de la intensidad del llanto indicó que era predominantemente corto e irritado. Los resultados apoyan el concepto de que el modelo en pico no es específico de los lactantes de las sociedades occidentales industrializadas, y puede representar un comportamiento universal de la especie humana.

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