of the physical target location, implying that the mean perceived target location is nearly coincident with the target. This finding means that perceived egocentric distance is quite accurate under full cues for the range of distances studied. When visual cues to distance are diminished, observers make systematic errors in their visually directed responding. When the target is closer than 2 m, they tend to respond to a more distant location, indicating that the perceived location is more distant; when the target is farther than 3 m, they tend to respond to a nearer location, indicating that the perceived location is closer.

Under the same viewing conditions that lead to accurate visually directed action, observers exhibit systematic errors in perceiving exocentric distances. We conclude that perceiving two locations without systematic error does not imply that the exocentric distance between them is perceived without systematic error. Further evidence of a dissociation between perceived location and perceived exocentric distance is provided by comparing monocular and binocular viewing. Whereas perceived location does not vary with the introduction of binocular cues (when monocular cues are sufficient for localization), perceived exocentric distance improves with the addition of binocular disparity.

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9. Binocular convergence is an egocentric distance cue that derives from the relative pointing directions of the two eyes. Binocular disparity is an exocentric distance cue and refers to the difference in the angular sizes of the left- and right-eye retinal images, both of which correspond to a single interval in three-dimensional space.

10. Gilinsky, note 1.

Violence Against Stepchildren

Martin Daly and Margo I. Wilson

On February 20th, 1992, 2-year-old Scott M. died in a Montreal hospital of massive internal injuries caused by one or more abdominal blows. At the manslaughter trial of his mother's 24-year-old live-in boyfriend, doctors testified that Scott's body displayed "all the symptoms of a battered child," mainly because of "numerous bruises of varying ages." The accused, who portrayed himself as Scott's primary caretaker, admitted assaulting the mother and other adults, but "I don't hurt kids." According to an acquaintance, however, the accused had admitted striking the child with his elbow because Scott was "bothering him while he was trying to watch television." The trial outcome was conviction.[1]

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A reader of any major newspaper is likely to have encountered similar stories, and may even have noticed that the victims are often the progeny of their killers' predecessors. Is step-relationship really a significant risk factor for lethal assaults on children? (Persons who reside with a partner and the partner's child or children of prior unions are here deemed stepparents regardless of marital registration.)

This issue has been obscured by a scarcity of relevant information in official records. In the United States, for example, the census has not distinguished between genetic parenthood and stepparenthood, and the national archive of homicide cases (the Federal Bureau of Investigation's *Supplementary Homicide Reports*) is also incomplete in this regard. But local data sets can be more informative. We examined the Chicago police department's homicide records, for example, and found that 115 children under 5 years of age were killed by their putative fathers in 1965 through 1990, while 63 were killed by stepfathers or (more or less co-resident) mothers' boyfriends. Most of these children were less than 2 years old, and because very few babies reside with substitute fathers, the numbers imply greatly elevated risk to such children. Just how great that risk might be cannot be determined, however, without better information on the living arrangements of Chicago children.

Canadian data permit somewhat more precise comparisons. A national homicide archive maintained by Statistics Canada from 1974 to 1990 included the relevant distinctions among parental relationships, and recent national probability sample surveys provide estimates of the age-specific distribution of such relationships in the population at large. Estimated rates of homicide by stepfathers versus genetic fathers in Canada are portrayed in Figure 1.[2] Because step-relationships were in fact increasing from 1974 to 1990, the use of recent surveys for population-at-large estimation ensures a conservative comparison: It is virtually certain that estimated numbers of stepfathers in the population are higher than actually prevailed over the 17-year period, and that the estimated homicide rates by stepfathers are therefore low. Nevertheless, the differential is immense.

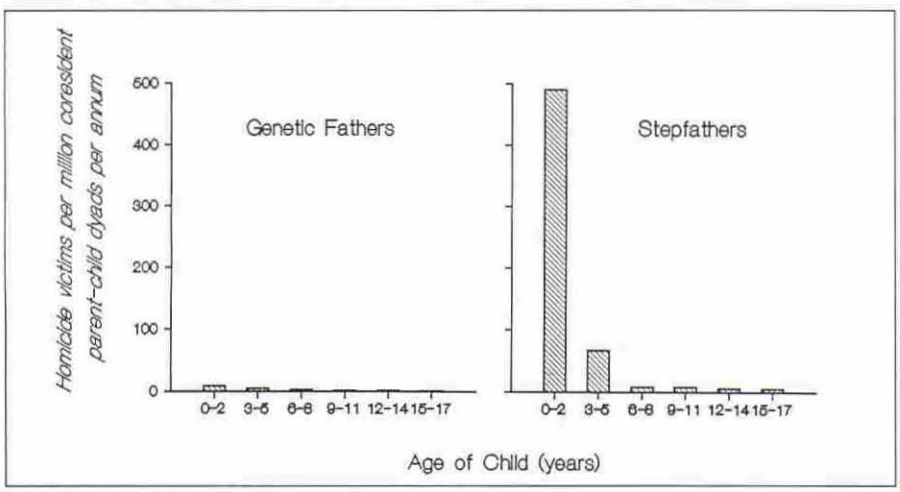

Fig. 1. Estimated rates of homicide by genetic fathers versus stepfathers in Canada, 1974–1990. Rate numerators are based on a Statistics Canada national archive of all homicides known to Canadian police. Denominators are age-specific estimates of the numbers of Canadian children residing with each type of father, based on census information on the numbers of Canadian children in each age class in each year and age-specific proportions living with genetic fathers versus stepfathers averaged across two national surveys, conducted in 1984 (Statistics Canada's *Family History Survey*) and 1990 (Statistics Canada's *General Social Survey*). Homicide rates for stepfathers are probably underestimates, for reasons explained in the text.

VIOLENCE IN STEPFAMILIES

Research on child abuse proliferated after Henry Kempe and colleagues' 1962 proclamation of a battered-child syndrome. However, no study addressed the incidence of child maltreatment in step- versus genetic-parent homes until 1980, when we reported that stepchildren constituted a much higher proportion of U.S. child abuse cases than their numbers in the population at large would warrant.[3] This excess could not be dismissed as an artifact of biased detection or reporting because it was most extreme in the fatal cases, for which such biases should be minimal: Whereas young children incurred about seven times higher rates of physical abuse in step-plus-genetic-parent homes than in two-genetic-parent homes, the differential in fatal abuse was on the order of 100-fold. Canadian and British data tell much the same story, with a large excess of stepchildren among reported child abuse victims[4,5] and an even larger excess among children fatally abused.[6,7]

Genetic parents kill children, too, but recent analyses indicate that the motives in these cases tend to be different. Whereas filicidal parents are often deeply depressed and may even construe murder-suicide as a humane act of rescue, homicidal stepparents are seldom suicidal and typically manifest their antipathy to their victims in the relative brutality of

their lethal acts.[7] In Canada, 44 of 155 men (28%) who slew their preschool-age children during a 17-year period did so in the context of a completed suicide, compared with just 1 of 66 men who killed stepchildren, and whereas 82% of the victims of stepfathers were beaten to death, the majority of children slain by genetic fathers were killed by less assaultive means. These contrasts are replicated in British cases.

Given that the rate of abuse and murder is greatly elevated in stepfamilies, one may still question whether step-relationship is itself germane. Might it not be an incidental correlate of other risk factors? Several possible confounds have been examined, but none seems to account for the differential risks among family types. Poverty, for example, is an important risk factor in its own right, but is virtually uncorrelated with the incidence of step-relationship in two-parent families in the United States or Canada and thus cannot explain away the family composition effects.[4,8] Large family size and maternal youth are additional factors with effects on abuse risk that are apparently distinct from the effects of step-relationship.[4,8] Finally, excess risk in stepfamilies might be due to excess numbers of violent personalities among remarried persons, but this hypothesis is refuted by evidence that abusive stepparents typically spare their own children.[4,9] Step-relationship itself remains the single most important risk factor for severe child maltreatment yet discovered.

DISCRIMINATIVE PARENTAL SOLICITUDE AND STEP-PARENTAL INVESTMENT

Elevated risk at the hands of stepparents has been abundantly confirmed, in a range of societies and with respect to the gamut of forms of child maltreatment.[3–11] But conflict in stepfamilies is not confined to these extremes. Research on nonviolent stepfamilies is a growth industry with a single focus: how people cope with the problems characteristic of step-relationships. It is important to emphasize that many people do indeed cope very well. Nevertheless, the research consistently indicates that step-relationships are, on average, less investing, more distant, more conflictual, and less satisfying than the corresponding genetic parent–child relationships.[8,12]

These results gibe with popular belief. Undergraduates impute unfair treatment and hostility to persons merely labeled stepfather or stepmother, negative attributions that are mitigated but not eliminated in people who have actually been stepchildren.[13] Folk tales of stepparental antipathy and mistreatment are cross-culturally ubiquitous and familiar to everyone.[14] Given these facts and the prominence of stepfamilies in a typical child protection worker's caseload, it is remarkable that almost two decades of intensive child abuse research elapsed before anyone asked whether stepparent households are really more dangerous than genetic-parent households, and, if so, to what degree.

It was neither folklore nor familiarity with case materials that inspired us to address these questions. We were stimulated by evolutionary logic and by the results of research on nonhuman animals. Current theory implies that natural selection shapes social motives and behavior to function nepotistically on behalf of blood kin, and animals have demonstrably evolved a variety of psychological mechanisms functioning to protect parents against parasitism by unrelated young.[15] Parental care is costly, and animals usually avoid expending it on behalf of young other than their own. But then why is the human animal so willing to enter into step-relationships that may entail prolonged, costly pseudoparental investments?

One hypothesis is that stepparenthood was simply not a recurring adaptive problem for ancestral humans, so people never evolved any psychological defenses against it. Nonnutritive saccharin, an evolutionarily unforeseen component of novel environments, tickles an evolved system for the recognition of nutritive sugars. Might substitute parenthood constitute a sort of social saccharin: an evolutionarily novel circumstance in which the evolved psychology of parenthood is activated in a context slightly different from that for which it evolved? We consider this hypothesis implausible because step-relationship is assuredly not a modern novelty. Mortality levels in contemporary tribal foragers suggest that remarriage and stepparenthood must have been common for as long as people have formed marital bonds with biparental care.[16] Moreover, the available evidence indicates that half-orphans who entered the perilous status of stepchild in a nonstate society faced a major diminution in the quality and quantity of parental care, and an elevated risk of death. In one study of a contemporary South American foraging people, for example, 43% of children raised by a mother and stepfather died before their 15th birthdays, compared with just 19% of those raised by two genetic parents.[11]

An alternative explanation for stepparental investment that is more plausible than the social-saccharin hypothesis derives from comparative studies. Although animals usually avoid caring for their mates' offspring of prior unions,

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exceptions have been observed in certain species of fish, birds, and mammals.[14] In each case, stepparental investment has been interpreted as *mating effort*, that is, as part of the cost of courting a single parent who, despite the burden of dependent young, remains an attractive prospective mate in a limited mating market. This explanation fits the human case, too. Stepparents assume their obligations in the context of a web of reciprocities with the genetic parent, who is likely to recognize more or less explicitly that stepparental tolerance and investment constitute benefits bestowed on the genetic parent and the child, entitling the stepparent to reciprocal considerations.

In this light, the existence of stepparental investment is not so surprising. But the fact of such investment cannot be taken to imply that stepparents ordinarily (or indeed ever) come to feel the sort of commitment commonly felt by genetic parents. Evolutionary thinking suggests that stepparental affection will tend to be restrained. Indulgence toward a mate's children may have had some social utility for many millennia, but it must rarely have been the case that a stepchild's welfare was as valuable to one's expected fitness as one's own child's welfare. We would therefore expect evolved mechanisms of parental feeling to be buffered against full activation when one merely assumes a parental role, and the empirical literature on stepfamily life confirms this expectation.[12]

PARENTAL LOVE IS MORE THAN JUST A ROLE

Even within the history of Western nations, step-relationships are no novelty. In fact, they were more prevalent in Europe in recent centuries than they are now, thanks to higher death rates of parents whose children were still dependent.[17] In premodern Germany, the age-specific mortality of children was elevated if one parent died and, more remarkably, was further elevated if the surviving parent remarried.[18] It seems that Cinderella was more than a fairy tale.

The cross-cultural ubiquity of Cinderella stories[14] reflects basic, recurring tensions in human society. Stepparental obligations are seldom attractive, and dependent children decrease a widowed or forsaken parent's value in the marriage market. In remarriages, preexisting children remain a focus and a source of marital conflict,[12] including marital violence.[19] People in all societies face these problems, and they deal with them in various ways. One solution is for remarrying parents to leave children in the care of postmenopausal female relatives. Another is for a widow to retain her children and marry her dead husband's brother, a practice widely perceived as reducing the likelihood or severity of exploitation and mistreatment, because the stepfather is an uncle who may be expected to have some benevolent interest in his brother's children. In the absence of such practices, children have been obliged to tag along as best they can, hoping that their welfare will remain a high priority of the surviving genetic parent. Sometimes the genetic parent has to choose between the new mate and the child, and may even become complicit in the exploitation and abuse of the latter.

American social scientists have interpreted stepparenthood as a role, only partly coincident with that of genetic parenthood. The role concept has usefully directed attention to the importance of socialization and scripts, but it is at best a limited metaphor that has diverted attention away from motivational and emotional aspects of the social psyche. There is more to social action than mere familiarity with the relevant roles. Why are people motivated to embrace certain roles and to shun others? Parents are profoundly concerned for their children's well-being and future prospects, but human concerns have no part in role theorists' explanations of human action.

As Donald Symons has argued, it is especially in the domain of social motives and feelings that psychology needs Darwinism.[20] Some aspects of human physiological and mental adaptations may be elucidated without consideration of how natural selection works, but the investigation of social motives and feelings gains crucial guidance from the recognition that it is genetic posterity, rather than happiness or life span or self-esteem, that has been the arbiter of their evolution. As any evolutionist might have anticipated, it appears that stepparents do not typically experience the same child-specific love and commitment, nor reap the same emotional rewards from unreciprocated parental investment, as genetic parents. Enormous differentials in the risk of violence are one particularly dramatic result of this predictable difference in feelings.

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Why Do Children Say "Breaked"?

Gary F. Marcus

Errors can yield special insights into learning mechanisms. In language development, perhaps the most notorious error is the past-tense overregularization. Most English verbs form their past tense regularly, by adding the suffix *-ed* (e.g., *walk-walked*). About 180 verbs, though, form their past tense idiosyncratically (e.g., *sing-sang*). Overregularizations result when the regular *-ed* suffix is applied to an irregular verb (e.g., *singed*).

Because parents almost never overregularize, these errors demonstrate that language learning involves more than mere imitation. Instead, children must possess mechanisms that detect and extend linguistic generalizations.

Although the production of overregularizations has typically been ascribed to the application of a mental rule, the mere fact that the regular pattern has been overextended does not guarantee that overregularization errors are produced by a rule. Instead, as Rumelhart and McClelland showed, a single uniform neural network that contains no explicit rules and makes no explicit distinction between regular and irregular words can produce overregularizations.[1]

In 1988, Pinker and Prince pointed out several limitations to Rumelhart and McClelland's model.[2] Since then, characterizing the mechanisms responsible for overregularization has become a central focus of detailed empirical comparisons between symbolic, rule-based models and connectionist neural network models that explicitly forsake rules in favor of networks of connections between nodes.

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THE RULE-AND-MEMORY MODEL

A model of overregularization that my colleagues and I have proposed depends on the existence of

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