

Can you kill a robot nanny?

Ethological approach to the effect of robot caregivers on child development and human evolution

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Sharkey and Sharkey (2009) assumed that regular daily or near exclusive robot care of pre-school children would cause developmental difficulties, mainly attachment-problems for the children. As they point out, the case of emotional neglect is difficult to prove, because it is not readily observable and it is an understudied phenomenon. In this commentary we stress the importance of an ethological approach to the issue by discussing the (1) evolutionary (historical) trends of social interactions in human communities and (2) experimental approaches to the development of social interactions in animals.

Many of us think that humans are more cultural than biological beings, and our biological needs are confined to some of the nutritional and, maybe, our sexual necessities. Such views paved the way for the often arising psycho-socio aberrations of human behaviour in modern societies that is explained as being the products solely of the changed cultural environment. However, perhaps most of the typical ‘civilization diseases’ are the outcome of the clash between our species-specific social needs and the modern social environment which is less and less suitable for expressing our naturally inherited patterns of behaviour (Perry, 2002).

Let us take a look back! For extended periods of time humans are believed to have lived hunter-gatherer social groups. Even today there are human communities resembling closely the ancient social structure of *Homo sapiens* living many 10,000 years ago (Burenhult, 1994). In a few places, for example, at the Pacific Northwest coast hunter-gatherers are able to settle permanently. These people live in small group of extended families (10–30 individuals), but they may form a larger group when resources are abundant. A dependent child grows up in the presence of the elderly, siblings, and other related or unrelated adults. This presents an almost continuous exposure of various socio-emotional interactions. These children have many opportunities to form and enrich social relationships.

Minimal human contact increases the risk for violent and aggressive behaviours (Perry, 2001), and we may consider that there is a better chance for healthy socio-emotional functioning (i.e. to be empathic, to share, to invest in the welfare of the community etc.) in children living in close-knit communities in comparison with our compartmentalized modern world.

Modern life significantly lowered the number of people living together. Our children are segregated with children of the same age for many hours a day. In everyday homes the time a parent spends with older children is counted in minutes (15 minutes per father, 32 per mother; Office for National Statistics, 2005, GB, <http://www.statistics.gov.uk/cci/nugget.asp?id=7>). Our modern western-culture society is the first asking a single adult to provide the needs of multiple children. The ratio of adult caregiver to the dependent child is actually reversed, compared to that of the hunter-gatherer (Perry, 2002).

In parallel with this, children are exposed to a growing amount of stimulation provided by various forms of technology. The effects of television and other electronic activities have affected the way children interact with others. Taking huge portions of the available day away from natural socio-emotional or other “human” activities, television ensures that new and non-social neural systems are being activated in comparison with children raised one hundred years ago. The implications of these changes have yet to be fully understood although it is likely that we are losing “social capital”. Especially with the introduction of the internet there are indications that the pattern of social interaction has changed in adults.

More importantly, despite “official” arguments to the contrary, new kinds of technical equipment and activities that have emerged in our modern societies have not served the (re-) socialization of the younger generations. Paradoxically, the new genres of gadgets, so called ‘entertaining electronics’, including personal music players, video-systems, computers, internet etc. have not increased the quality of social interaction in peers. This may be because the common feature of these tools is the almost complete exclusion of social interaction with other humans. The seemingly ‘communal’ life of ‘chat forums’ and online games is rather a fake substitution of real social interaction with real people. Thus entertaining electronics inadvertently enhances the alienation of young people (or children) from their living environment, and at the same time they may give the false illusion to parents that such activity is still better for their children than the dangers of being under the influence of some malevolent gang or hallucinogenic drugs.

Very few people realize that the real need of their children is not constant entertainment, but rather an almost constant social interaction with humans of different ages – in an ideal case with the members of an extended family. We tend to think, incorrectly, that children are bored with social interaction and they would rather spend their time playing something ‘really cool’.

Accordingly, from an evolutionary point of view, it is clear that both the quantity and quality of social interaction in humans is on the decrease. However, the idea of introducing robot nannies brings in other problems of learning inadequate patterns of social behaviour that can seriously disrupt (the remaining) social interaction among humans. Note that social behaviour patterns may be partly genetically encoded but emerge through an epigenetic process by interaction (i.e. learning) with environmental stimuli. The comparative psychological and ethological literature on animals and humans provides a lot of insight on these issues. Information comes from two sources: observations on the effect of social deprivation (or maltreatment) and cross-fostering experiments in animals.

In the case of the former, the detrimental effect of different levels of social deprivation was shown experimentally by Harlow and Suomi (1971) in Rhesus macaques. Animal studies produce only indirect information about the development of humans. Children have longer sensitive periods, therefore we cannot be sure whether abnormal environmental exposure results in similar malorganization in humans. Children neglected in early childhood (institutionalized or feral) provide an analogy to animal deprivation experiments. Although one may question whether any child has really been raised by animals, there is evidence relating to the development of children who have grown up with minimal human contact. Such neglect can be characterized by decreased sensory input (lack of touch and species-specific social interaction, including language).

Chaotic and inattentive care can produce serious developmental delay and malformation in socio-cognitive behaviour (Rutter et al., 1999). Adoption of children prior to 2 years of age from a Lebanese orphanage doubled the mean IQ measured at the age of 6 years, compared to that of children who remained in institutional care (Dennis, 1973). Neglect or abuse results in disturbed attachment capacity that increases the risk of violent and aggressive behaviours (Perry, 2001). Several similar studies provided evidence that the younger a child was at the time of adoption the more it recovered from the deficits of the neglectful environment (i.e. Read et al., 2001).

These developmental problems are often linked to brain abnormalities both in animals (Diamond & Hopson, 1998) and humans. Brain size of neglected children is strikingly smaller (Perry and Pollard, 1997). Metabolic activity abnormalities can be detected by functional MRI in brain areas related to the cognitive, emotional and social behaviour (Chugani et al., 2001). Thus in early childhood specific sensory stimuli provided by a loving and attentive caregiver are necessary for the normal neural development.

Cross-fostering experiments with animals provide an even better analogy to the proposed scenario of robot nannies. In such studies the offspring is removed from the biological parents and raised by surrogates. Cross-fostering experiments

can take place either between species or with families of the same species, and it turns out that the foster parent can have a marked effect in both cases on the offspring. Observations suggest that many physiological and behavioural traits become modified through the experience of the foster parents. For example, genetically enhanced hypertension can be reduced by 20–30 mmHg in rats (*Rattus norvegicus*) if these hypertensive pups are cross-fostered to a normotensive mother within the first 2 weeks of birth (Ashton et al., 2003). This physiological change is probably caused by the different behavioural attitude of the foster parents. Social attitude of the subjects can be also affected through contact with a different species. Cohousing of rhesus macaque (*Macaca mulatta*) and stump-tail macaque (*M. arctoides*) increased the proportion of reconciliation (friendly reunion after an aggressive encounter) in the rhesus macaques, due to the effect of the more relaxed dominance style of stump-tail macaque (de Waal et al., 1993).

Importantly, however, the changes in the behaviour of the offspring can also affect markedly the social preference for their own species. Such situation can lead to a phenomenon called reproductive isolation when members of two adjacent populations *do not* prefer each other as social and sexual partners. For example, in nature, pink cockatoos (*Cacatua leadbeateri*) often raise the chicks of a related cockatoo, the galah (*Eolophus roseicapilla*) in their nests. Consequently, galah chicks' contact calls, which maintain social cohesion, are more similar to those of pink cockatoos (Rowley & Chapman, 1986). This environmental effect may lead to reproductive isolation as well. The songs of two Darwin's finches (*Geospiza fortis* and *G. scandens*) present a barrier to interbreeding, but if chicks are prevented from learning the song of their father, the two species can hybridize (Grant & Grant, 1997).

Accordingly, social interaction with a robot nanny represent a case for cross-fostering which (especially during the sensitive phase of social learning in children) could promote the disruption of normal social behaviour toward humans, and thus seems to be ethologically untenable. Even the disruption of mating behaviour could occur leading to reproductive isolation within humans.

In our view both from an evolutionary and a developmental perspective the introduction of robotic caregivers will clearly lead to the deterioration of human social relationships and social-emotional behavioural interaction. This will be the case even if robot nannies are "very similar" to humans because inevitable they *will not be* humans. Before we rush with these robots to the nurseries and kindergartens we may want to look critically at the issue of social relationships from an ethological point of view, because it seems that the evolutionary rules of life are different whether we are in contact with the same or a different species!

If however, we continue along this road, a new form of humans, *Homo technicus*, could eventually emerge. These people will not be able to think outside the

framework of the individualised entertaining systems, and the children of these people will be socialized to follow these non-human behavioural patterns from the very early age. The real problem of this rather scary scenario is that at present human society is based on the cooperative efforts of various groups of people, and it is doubtful whether the more and more individualized members can participate in these common actions with the required level of social skills and empathy. Therefore we would forewarn researchers and people of the general public from greeting with ovation the arrival of this new ‘human-substitution’.

Acknowledgements

This work was supported by the EU FP7 ICT-215554 LIREC (LIving with Robots and intERactive Companions).

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