(Mitcham, 1994, 182). I will now argue just what kinds of affective robotics systems should be promoted or restrained.

There are a number of possible critiques of personal robotic technology from the perspective of the philosophy of technology and I would like to address what I believe to be the most interesting. When we look at the strategy of building personal robotics systems that work to seamlessly automate the modern household, we can see that the objectified processes are those of the home life. The dream is to remove the workload of running a home from its inhabitants by having that work done by systems that do them for us as unobtrusively as possible, robots that do our laundry, clean, cook etc. Mitcham, inspired by the work of Ivan Illich, argues that instead of tools that do the work for us automatically, perhaps we need more tools that interact with us using our energy and guidance since:

> [t]he later less and less allow end-users to introduce their personal intentions into the world, to leave traces of themselves in those rich constructs of traditional artifice that have served for millennia as the dwelling place of humanity. Users now become consumers and leave traces of themselves only in their wastes (Mitcham, 1994, 184).

The phenomenology of humans in relation to robots is a fascinating development in the history of technology. This is a complex subject but an approach might be built on the lines of Albert Borgmann's device paradigm (1984). The device paradigm is a subtle concept but briefly put, it occurs when technology turns aspects of our lives into interactions with various black boxes and we can no longer engage with, or even understand, the underlying relationships to the world or each other that the technology or 'device' occludes. Home automation and robotics might just accelerate the process of hiding the process of home life behind a friendly façade of technology resulting in the final full commodification of our interpersonal lives. Every aspect of our home life will be fully encompassed by technology that we cannot completely understand and therefore we would be unable fully to comprehend just what it is about our home life, and our relationships with those we share our domicile with, that have been unfavorably altered by home robotics and automation. The technology will fulfill our perceived needs and we may come to see our family, and ultimately ourselves, as mere dysfunctional devices that serve no real purpose and we might work to replace them with our perfect robotic companions. This sort of critique has already made for entertaining science fiction books and movies but I think the reality might be more subtle. In the objectification of domestic procedures we may lose the ability to live artfully and replace that with simply the ability to live efficiently. Our lives will be effective but un affective.

I would like to make some modest additions to the design philosophies described in the sections above with the hope of contributing ideas that will cause us to build personal robotics technologies that will create a system of domestic relations between all the agents, human and artificial, that will come to inhabit the homes of our near future.

First, affective robots should not play lightly with human emotions. It is certain that these machines will be able to elicit real human emotions via their simulated ones, and some of these may at times be inappropriate or dangerous. To this end we should also recognize an 'uncanny valley' in the degree of emotion simulation

programmed into our machine. Emotions should thus remain iconic or cartoonish so that they are easily distinguished as synthetic even by unsophisticated users.

Secondly, affective robots must be used to enhance the social world of their users and not to isolate them further. Affective robots should not be used as wholesale replacements for human interaction. As this technology becomes more compelling, the possibility of this happening is more likely. Computer and information technology has a seductively immersive quality that can act like a cocoon protecting the user from messy interactions with other humans, affective robotics can easily play into this tendency and this should be avoided.

Finally, affective robotics gives us the opportunity to discover interesting facts about the social psychology of friendship. While working to make our technology friendlier, we should pay attention and learn how to incorporate those findings into other technologies.

Affective robots will be successful only if they function as tools that enhance social bonding and cooperative behavior in the human lifeworld. They must not be used to replace real people or pets, but as a new addition to these existing relations they will be a welcome technology, and perhaps we will make some new friends in the process.

References

Agence France Presse, 2005, As Japan goes grey, toymakers design dolls for the elderly in LexisNexis, copyright 2005 Agence France Presse all rights reserved, February 23, 2005.

Aproberts, A., 2004, They walk among us, *Robotics Trends* (http://www.roboticstrends.com/displayarticle447.html), copyright McClatchy Newspapers Inc., July 28, 2004.

Biever, C., 2004, Machines roll in to care for the elderly, *Robotics Trends* (http://www.roboticstrends.com/displayarticle395.html), copyright 2004 Reed Business Information US, a division of Reed Elsevier Inc., May 18, 2004.

Borgmann, A., 1984, *Technology and the Character of Contemporary Life*, University of Chicago Press, Chicago.

Breazeal, C., 1999, Robot in society: friend or appliance?, in: *Proceedings of the 1999 Autonomous Agents Workshop on Emotion-Based Agent Architectures*, Seattle, WA, pp. 18–26.

Breazeal, C. A., 2002, *Designing Sociable Robots*, MIT Press, Cambridge, MA.

Breazeal, C., Brooks, A., Gray, J., Hoffman, G., Kidd, C., Lee, H., Lieberman, J., Lockerd, A., and Mulanda, D., 2004, Humanoid robots as cooperative partners for people, under review (http://robotic.media.mit.edu/Papers/Breazeal-etal-ijhr04.pdf).

Brooks, R. A., 2002, *Flesh and Machines*, Pantheon Books, New York.

Dennett, D., 1996, *Kinds of Minds*, Basic Books, New York.

Duffy, B., 2003, Anthropomorphism and the social robot, *Robo. and Auto. Syst*. **42**:177–190.

Feenberg, A., 1995, *Alternative Modernity*, University of California Press, Berkeley and Los Angeles.

Garson, B., 1988, *The Electronic Sweatshop*. Penguin, New York.

Hornyak, T., 2002, Seal of approval: researchers probe fuzzy logic of relaxation with cuddly robot, *J@pan.inc* (http://www.japaninc.net/article.php?articleID=819), June, 2002.

Japan Economic Newswire, 2005, TokyoNow: elderly love therapeutic seal robot, copyright 2005 Kyodo News Service.