A number of robots have already been built that attempt to serve several of the needs of this population and a few have even achieved some success. It is informative to review some of the successful robot designs to date.

Paro is a robot baby seal. It has soft white fur and big eyes with a cute little nose, and looks like an unremarkable stuffed animal (Hornyak, 2002). But under the white hygienic fur is a complex array of sensors and actuators that cause *Paro* to react in interesting and stimulating ways when someone speaks to it or pets its fur. *Paro* even behaves according to a circadian rhythm mimicking a natural sleep wake cycle. *Paro* is used for robot therapy, where the robot is brought into nursing homes and groups of the elderly are given the opportunity to interact with it. Typically they cuddle and hold it like a real animal and talk to it like it was a small infant to which the robot responds with gentle movements and sounds. Oddly enough, most of the participants find interacting with the machine compelling, and some of the patients with age related dementia even have a hard time realizing that *Paro* is just a machine (Japan Economic Newswire, 2005). Faced with the monotony of institutional life, watching television, or interacting with a robot, many of the elderly find the latter choice the most compelling.

Another problem facing the Japanese elderly is that there has been a downturn in the number of children in the country and this fact, along with the death of the extended family, means that many elderly do not interact with children as much as they might like. To address this need, the toy company Tomy, in conjunction with a bedding manufacturer, has created *Yumel* a small robotic doll. "The Yumel doll, which looks like a baby boy and has a vocabulary of 1,200 phrases, is billed as a "healing partner" for the elderly …" (Agence France Presse, 2005).[3] This doll is not much of a robot since it only moves its eyes and plays pre-recorded phrases without moving its mouth. Even so it has proven popular, which is an interesting phenomenon in itself. One may set *Yumel* to match the users sleep patterns and the users are supposed to take it to bed with them where they can cuddle with it and it will sing them sweet lullabies. In the morning it wakes its owner up at a preset time. An additional 'feature' is that it will occasionally beg you to buy it presents and new clothing, which can be obtained, of course, from Tomy. Just what the 'healing powers' of this kind of machine are is hard to tell, but nevertheless it is a popular item.

A similar toy aimed at both adults and the elderly, with children seen only a secondary market, is the doll *Primopuel*. This doll looks like Pinocchio without the nose and, like *Yumel*, also has a modest vocabulary and can babble on like a small child. This doll has proven to be very popular and Bandi, its maker, has made millions of Yen from this fad. Owners have reportedly taken to the robot as if it were a real child and it serves as a kind of surrogate for childless couples and other lonely adults (ibid). This growing market for companion robots has not, as yet, spread too far out from Japan but efforts to sell these products are proceeding in Europe and America.

[3] The Yumel product website can be found here (http://www.tomy.co.jp/yumel/index2.asp).

5 Affective Robotic Design in America and Europe

5.1 Sociable Robots at MIT

There is also a desire to build robotic companions on the other side of the Pacific. Some of the most interesting work on this subject has come out of the *Robotic Life group* headed by Cynthia Breazeal in the MIT Media Lab.[4] Breazeal was a student of the revolutionary roboticist Rodney Brooks, and she has taken the maverick milieu Brooks brought to the AI lab at MIT and run with it in fascinating new directions. The robots created by this lab so far have garnered a great deal of media attention due to their compelling sociable qualities.

Most famous of these robots is perhaps *Kismet* a machine built to interact with people that Breazeal worked on for her doctoral dissertation at the MIT AI lab.[5] This was the first serious attempt in American academic robotics to build a machine that could interact with humans on a friendly and personal level. Her team gave Kismet some of the affective responses as they believe adding these capabilities to be "…a critical step towards the design of socially intelligent synthetic creatures, which we may ultimately be able to interact with as friends instead of as appliances" (Breazeal, 1999, 25).

Taking the lessons learned from *Kismet* the lab is now working with Hollywood special effects wizards from Stan Winston Studios to create *Leonardo* the next level in sociable robots. Where *Kismet* clearly looked like a robot *Leonardo* does a better job of hiding the fact and looks like a strange yet cute mammalian creature straight out of a movie. *Leonardo* is controlled by animatronics, but what separates it from mere expensive puppets is that its movements are completely controlled by a computer and it is programmed to react and interact with humans as humans. Leonardo looks at you when you talk to it, tries to infer your intention by your body movements and gestures, and in return gives you as the user cues on its mood and beliefs through facial expressions and body gestures.

The goal is to make machines that do not require that the user change his or her ways of being in the world and interacting with human and nonhuman agents. Breazeal feels that we have evolved a complex social system that works admirably and roboticists need to learn how to make their machines fit in with our already preexisting ways of interacting rather then foist on us an interface that is alien and hard to use (Breazeal, 2002). This is particularly necessary when dealing with non-technical users, such as users in a home where the machine needs to fit in as a fellow member of the household and not disrupt the lifeworld and practices of its human inhabitants. This constraint means that the robots must match our

[4] http://robotic.media.mit.edu/

[5] For details on Kismet: (http://www.ai.mit.edu/projects/humanoid-robotics-group/kismet/kismet.html).