

Feature

AIBO – the No. 1 selling service robot

Joanne Pransky

The author

Joanne Pransky is an Associate Editor of this journal.

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Abstract

Sony's AIBO entertainment robot has broken all records for the number of robots sold in the shortest time period. The AIBO is an autonomous home entertainment robot with artificial intelligence. Its behavior simulates a dog's in its ability to walk and play, with built-in functions for emotions, instincts, learning and growth. Yet AIBO was not intended by Sony to be a dog substitute, but to further the man-robot interaction. It has received an overwhelming response worldwide and it appears as if AIBO may be just the beginning of Sony's home entertainment robots.

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1999 marked the first year that the prestigious *World Robotics*, a one-of-a-kind annual publication put together by the Economic Commission for Europe (ECE) and the International Federation of Robotics (IFR), included a survey on service robots. Included in this premier report were entertainment robots, which, coupled with a few other new service robot classifications, were forecast to total 1,000 installations for the period 1999-2002.

This prediction was surpassed – five times the forecast amount – in just four days in June 1999 by one robot alone – the AIBO entertainment robot. Further, what no one was able to predict, including Sony Corporation, the manufacturer, was that the AIBO also broke all records for the greatest amount of robots sold in the shortest amount of time. The first run of 5,000 AIBOs, the ERS-110, was met with an overwhelming response – one that almost broke Sony's Webserver: 3,000 sold out in Japan in 20 minutes on the Internet and the remaining 2,000, made available only in the USA, were all sold on the Internet within four days.

To respond to the consumer demand, 10,000 of a slightly modified edition of the AIBO, the ERS-111 (see Plate 1), were offered for sale in November 1999 via the Internet in the USA, Japan and Europe (Austria, Greece, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Portugal, Spain, Switzerland, the UK, Belgium, The Netherlands, Sweden and Norway). "Adoption agreement" order forms were taken over a ten-day period. Sony received 135,000 orders and the 10,000 lucky customers were picked at random.

In the third and most recent sale held in February 2000, there was no limit on the number of AIBOs available and plans were, according to Sony, to manufacture an AIBO for every order received during the official order period. As of October 2000, Sony has yet to release the formal sales figures from the last sale or any dates for a future production run.

All robots have been at a price tag of US\$2,500 with an additional US\$500 for a performer kit, a motion editor software option. Financing was available for the first time on the AIBO Web site during the February 2000 sale through Sony Finance, although fewer than ten consumers actually took advantage of this option.

Plate 1 AIBO ERS-111



Why is the AIBO so successful?

It is the first autonomous home entertainment robot to utilize artificial intelligence (AI). Hence, part of the name derivation – “AI”, pronounced “eye” since it is also a robot with eyes, with the “BO” coming from robot. *Aibo* also means partner or pal in Japanese.

Mechanically, the 3.5lb AIBO has 18 motors, three in the head, three in each of the four legs, two in the tail, and one in the mouth, that altogether produce a total of 250 types of movement. It has 16MB of RAM, a 64-bit MIPS RISC processor, and a removable Sony “memory stick” with 8MB of flash memory that stores Aperios, Sony’s new real-time embedded operating system. The robot also has a 7.2V lithium ion battery that lasts about 1.5 hours, a 180,000 pixel CCD color camera, two stereo microphones, one speaker, two heat sensors, an infra-red range finder, four spatial acceleration sensors, one angular velocity sensor, and four switch pressure sensors.

Toshitada Doi, the creator of AIBO, recently described AIBO in a Japanese newspaper article entitled “Matrix”:

AIBO is equipped with six emotions (joy, sadness, anger, surprise, fear, and discontent) and four instincts (the desire to interact with people, to search for favorite objects, to move around, and to re-charge its battery). These values constantly change depending on the external stimulation and its own movements. When it is praised, loved, or fulfills its desire, the happiness value increases. On the other hand, when its desire is not met, its sadness and anger values increase. When it barks, its anger subsides.

The “character” of AIBO is what determines the relation of the sensor input and values, and the relation of the pattern of activities and values. The character is displayed in a numerical value in matrix format.

The character of AIBO is ever changing. If AIBO is well interacted with, it will be active and lovable. However, if ignored, AIBO will become lazy and not react to people.

Additionally, there is a growth pattern programmed in correlation to the hours and ways AIBO is raised (baby stage, child stage, youth stage and adult stage). AIBO’s movements rapidly change in compliance with this growth.

Compared to a live creature, AIBO is definitely simplified (Plate 2). But when you spend some time with it, it is strange that you become attached. Its program and inner conditions are stored to a small device called the memory stick. If you analyze this, you are immediately able to determine how AIBO has

Plate 2 Will children need to read a manual before playing with their first mechanical pet?



been raised. The matrix that represents AIBO's character is clear and evident too.

Is AIBO a fad, a fascination, or is it the future of our pet relationships?

It appears that AIBO may be just the beginning of the home entertainment robots. After one and a half years since its birth, AIBO still seems to be in high demand and, for some owners, AIBO has become a lifestyle. There are AIBO expos and clinics where one can bring one's AIBO for an annual checkup. There are AIBO chat rooms, soccer tournaments, ClubAIBO, and a soon-to-be published *AIBO Town Magazine*.

Despite many who purchased the AIBO because their living situation was not conducive for a biological pet, Sony did not intend for AIBO to replace the living pet. "Our researchers know the limitations of a

machine", comments Yosh Kambe of Sony Marketing, whose title is AIBO keeper. "We just want to add a new type of companion for future millennium life. We have no intention of competing with the real animal companion. That's our long-term goal – living with robots. It's not just playing with toys – it's more serious. We are dreaming of how we are going to live with robots in our future life."

And the future is now what Sony is focusing on. There are potential future enhancements for AIBO that the Tokyo development team is considering, such as voice recognition and image recognition, but there are no formal announcements as of yet. Opening up the market to other continents and countries, such as Asia and more European countries, is also a possibility. Sony is working on potential other types of entertainment robots, but there are no specific plans to release a different type of robot.