Successful Intuitive Computer Interfaces for Birds, and Other Forays Into Giving Parrots Electronic Enrichment

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Abstract:
Across the United States zoological facilities are giving their captive animals ways to control their environment, as well as novel forms of stimulation through electronics. This paper follows the successful progress and application of a computer interface that is bird-intuitive. Without training the two parrot participants were able to engage in totally novel (and unusual) behavior by playing with the computer interface. Applications of the interface, internet, and voice activated light switches were used to enrich the parrots, and other possible enrichments were explored.

For three years the Skidmore College Psychology department was home to SPEW, the Skidmore Psittacine Enrichment Workshop. Consisting of myself and my assistant Bradley Rosen, we experimented with novel electronic ways to enrich the lives of captive parrots.

This work was inspired by the "Interpet Explorer" project at the MIT Media Lab. Worked on by Dr. Irene Pepperberg, Dr. Bruce Blumberg, and graduate student Ben Resner, the project eventually fell through with limited results. The grey parrot who was worked with, Wort, used a joystick to control the computer. The program allowed him to access digital content, such as bringing photographic images onscreen. In talking to the professors, I learned that the bird had seemed disinterested in the content, and had been trained to use the joystick. I found myself truly excited, as they had developed some amazing ideas. I sat down and designed a different computer interface, planned some bird-friendly software, and acquired lab space (Though I must add, support is slim in the academic world for this kind of project, thank you Greg.) I code named it "Parrot_Wings" and spent the next few years refining the interface.

The interface was created using Macromedia Flash, and an IMB ThinkPad laptop with a built-in microphone was used. The laptop was chosen because it had a flat-panel display. Many species of bird have a higher flicker fusion frequency than human beings. Meaning if you were to flash a light at a bird, and increase the speed that it was flashing, you would eventually see a solid white light while the bird would see a very quickly flickering light. Cathode-ray tube displays (CRTs,) such as typical computer monitors and televisions, shoot energy at phosphor to create an image one line at a time. It's possible that a bird could see the image fading and being redrawn by the CRT, while a human being would see a solid picture. Also, CRTs could give off light invisible to humans but visible to birds, such as near ultra-violet. I've seen a number of experiments where birds respond to television images, such as pigeons courting video images, but to eliminate concerns about the CRT displays the flat-panel monitor used. This was

especially important as the the on-screen activities would involve small changes to color and detail that any visual confusion could make invisible to the birds. Dr. Bruce Blumberg and Dr. Irene Pepperberg kindly consulted me, as they had used flat panel displays since Dr. Pepperberg noted parrots would peck at images of toys on a flat-panel, but ignore CRT images.

The two parrot participants were Kinsasha, a five year old female (sex unconfirmed) African grey parrot, and Icarus, a one year old cockatiel whose egg-laying satisfied questions of gender. Kinsasha had chewed off space bars and watched me play video games for years, while Icarus was electronically naive.

The interface had certain goals, no training would be needed for the birds to use the interface, and there would be no physical contact with any part of the interface. It seemed obvious that joysticks, buttons, or other control devices would eventually be obliterated due to the destructive nature of parrots. The whole thing would also have to work on any normal computer, without special equipment.

To be used without training, the interface would have to be intuitive to parrots. A virtual joystick was created. Up, down, left, right, and center could be selected through a "squawk detector." Any sound directed at the microphone over a selectable threshold would trigger the top "button" to begin blinking. After about half a second, the top button would "press" and anything onscreen that reacted to the top button. If there was more sound above the threshold after the top button began blinking, the next button in the sequence would blink. This continued until the squawking stopped or the bird cycled through all the buttons and the center button would be "pressed." When used, the interfaced opened with the buttons on an otherwise blank screen. The buttons would each open different content. In this way the virtual joystick functioned as menu system. Once content was opened it would close automatically with disuse, or would close when the center button was selected, bringing the bird back to the menu.

The interface was modified for Icarus, as she was a younger and less adaptable than Kinsasha. Content would scroll across the screen, and if Icarus chirped, the content would react. Anything that frightened her could be turned off by restarting her interface and changing options.

The birds took to their interfaces quickly. Icarus was initially frightened of the laptop placed 8 inches away, but after 15 minutes of being left alone she stopped hiding on the floor of her cage and was chirping at the computer screen. The birds were not in each other's company when initially using the interface, and each began using their interfaces in different locations. I placed the laptop a few feet away from Kinsasha's cage on a chair and demonstrated how it worked by whistling at the computer for thirty seconds. I stepped away to man the video camera on the other side of the room and let her play with the interface. She stared, chirped, and in my opinion, seemed surprised when the ball on screen bounced. She increased the frequency of her chirps making the ball bounce repeatedly. She was given the opportunity to work with the interface ten times, the period of exposure lasting between 15 and 25 minutes over the space of several

months. I continually edited the content between exposures to see what would interest her.

The birds' reactions surprised us. Kinsasha not only operated her interface, but would close games when she was done with them, and narrated the onscreen events. Two such narrations were recorded on video, where Kinsasha said "up" while bouncing the ball on screen, a habit of hers while playing with real balls. Also, before closing a game she made a distinct creak of door hinges, a noise she makes when people leave a room. Also, without training she played some complicated games. One consisted of a character on a checkerboard surrounded by whitespace. The character could be directed anywhere on the screen by selecting a direction on the joystick. Initially she walked the character offscreen, but after a few exposures she was directing it to the goal, which would move around the checkerboard when the character contacted it. In one recorded instance, she directed the character to the goal twice in a row (unlikely to happen by random chance) and there was evidence that she compensated for making mistakes in selecting buttons. Also, in games where only one or two buttons would activate content, those buttons would be selected while the useless buttons were not.

Icarus was a relatively quiet cockatiel, only chirping or uttering contact calls. When she first used the interface I listened from the next room as her calls increased in frequency. I stepped into the room to verify she was looking at the interface, and she indeed was. Within the next 30 minutes her frequent chirps became sustained whistles, and developed into whistled songs. She had never been known to sing before. After this, singing became part of her repertoire.

It was obvious that the interface could provide entertainment as well as encourage novel behavior. It was discovered that computer sounds, such as bleeps, splats, and clicks, were distracting. The birds would respond to the audio instead of the video, and begin activating the interface at random through their vocalizations. Games that used human speech (such as one that matched printed words, pictures, and spoken words as the bird scrolled through a list, then could choose to play the speech audio) did not cause this problem, but this is likely because these two birds preferred to respond to noises instead of speech.

In addition to the computer interface, Kinsasha was given a commercial voice-activated lights witch. As the room lights were on a timer this gave her the opportunity to control her environment. The light switch confirmed its use by making beeps. This caused the same kind of distracting stimulation that led to the removal of audio from most of the interface games. Instead of using the light switch to control the lamp, she would just "speak" to it using the same beeps it produced. When she tired of this activity the light was left as it was, whether this meant she was left in the dark, or the light would be on all night didn't seem to matter. I think a light that responded only to a specific noise, and had no output other than turning on or off the lights would work better for a future experiment.

The other big electronic adventure was networking the birds to our office using webcameras. The images were small and low resolution, and the birds never seemed to look at them or react to them. The audio, however, garnered responses. Kinsasha had developed a nasty habit of barbering her feathers, and when she was seen doing this over the video, she would stop with a chastisement sent to the speakers in the lab via internet. Also, the birds calmed noticeably if they were frightened by a noise from outside the lab and were spoken to over the audio. It would be feasible to combine the interface with audio and video feeds allowing birds to check in on each other and their people, while keepers looked in on their birds from any location.

At one point Icarus was observed over the webcam for four hours. Her behaviors were ranked based on how social/interactive they were. Sleeping and holding still garnered a 0, contact calls were worth 4, and singing scored 5. Behaviors that were non-social but more active than sleeping, scored 3 or below. Observations occurred every 20-30 minutes. A coin toss determined if the observations would be coupled with use of the webcamera or not. When there was no audio or video feed given, Icarus scored an average of 1. Without social stimulation she spent her time asleep, or sitting about. When webcam stimulation was given she would respond with contact calls, increased activity, and even singing. She averaged a 3.5 with stimulation. She did not score as highly as she would have if people had actually been in the room (frequent chirping, playing with toys, etc) but it was evident she responded to the five webcam interactions, while remaining inactive otherwise. This could mean that the internet can give some social interaction to animals who have to be left alone for periods of time.

It's possible that using an interface and some machinery a bird could turn on a mister, fan, or call its owner at work. Using technology the aberrant behavior of feather chewing was stopped in a situation where it was not feasible for me to be next to my bird. There are a lot of possibilities in giving technology to parrots, and these two have demonstrated they can use it without special training, and they have the ability to benefit from it. While never a replacement for snuggling and face to face contact, technology can augment our relationships with captive birds. After Kinsasha had used the interface on her own and demonstrated she could use its complex functions without human assistance, I began using it with her, and playing computer games with your parrot is a great pastime.