

# Say It with Feeling

*Robots and artificial creatures on computer displays are being designed to show more emotion. The goal is better communication with people.*

**Wenn Roboter und Bildschirmmännchen Gefühle zeigen, dann ist das nicht nur Spielerei. Werden die Erkenntnisse aus der Verhaltensforschung richtig umgesetzt, können sie uns den Umgang mit Maschinen und Computern erleichtern.**

"Hello there, I'm Mexi." Like a *curious* rabbit, the little *fellow* with the *tinny* voice *perks up* his ears and *beams*. He stares at the unfamiliar guest for a while, but then his attention seems to *wane*, and he *gazes* at the floor apathetically, then sets his sights on two colored balls that lie in front of him on a table – until that gets too boring for him as well. "Mexi has needs just like a person," says 43-year-old Dr. Bernd Kleinjohann, Deputy Director of C-LAB in Paderborn, Germany, a research institute run *jointly* by Siemens and the University of Paderborn. "Once a need has been satisfied, he loses interest – like an infant."

Kleinjohann is one of the fathers – or rather creators – of Mexi, the Machine with Emotionally Extended Intelligence. Mexi is not a living thing, but rather a somewhat bizarre *concoction* made of plexiglas, microchips, motors, cameras and small lights. Nevertheless, with its *protruding* eyes and its lips of red *cord*, the robot looks somehow human, almost *endearing*. You automatically smile back and catch yourself wanting to talk to this artificial head. And indeed, Mexi can already speak short sentences and express emotions. For instance, he raises his voice when he's happy, and lowers it when he's in a bad mood.

## Role Models

Does Mexi have feelings? "No, he just appears to," says Kleinjohann, shaking his head as he opens the Emotion Engine on a PC, from which Mexi can be programmed. Three slide controls appear on the screen. They represent the alternating desires Mexi tries to satisfy: communication (looking at people), play (watching colored balls) and greeting the Linux mascot – a penguin doll. With the help of another control, Mexi can display a wider range of emotions. He

can show fear, for example, by *cringing* when someone waves a hand in front of his camera eyes or comes too close for comfort.

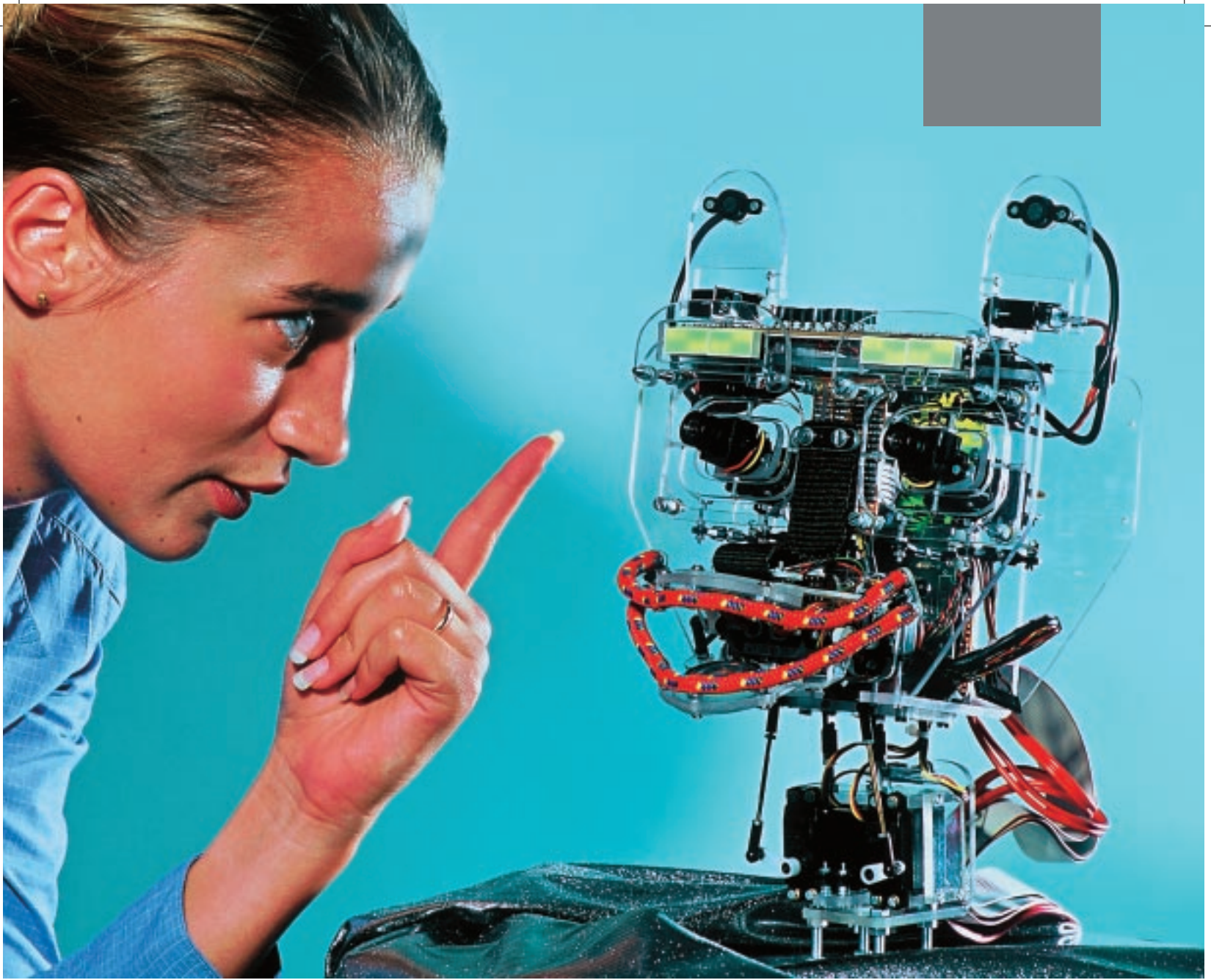
Mexi has two famous role models: Cog and Kismet, both of which were built at the Massachusetts Institute of Technology (MIT) just outside of Boston. Robot pioneer Professor Rodney Brooks *proceeded from* the hypothesis that a robot can *acquire attributes* similar to those of a human being only if it is allowed to explore its surroundings in the same way a small child does. Cog is now able to *distinguish* the faces of his *handlers* from strangers' faces, and he can tell whether or not a person is looking directly at him. Like Mexi, Kismet, the *successor* to Cog, has feelings. If no one pays attention to him, he looks sad. "Kismet was designed to emotionally *blackmail* people," says his creator, Cynthia Breazeal.

## The Need for Emotions

*Neglected* by cognitive researchers until recently, emotions now seem to be essential to the success of artificial intelligence, a field that has disappointed many since its promising birth in the 1960s and '70s. The Affective Computing research group at MIT is proceeding from the *assumption* that emotions are important for the ability of intelligent machines to make flexible and rational decisions.

The researchers draw this inference in part from studies *conducted* by Antonio Damasio, a neurologist at the University of Iowa. In the course of his research, Damasio discovered that emotionally disturbed patients make their decisions much as computers do – inflexibly and according to simple if-then patterns. All of this is speculation for Bernd Kleinjohann. He's not particularly concerned whether Mexi's emotions are *genuine* or pretend. What's important, he believes, are the feelings that the artificial head *triggers* in people. "People project their emotions onto technical devices they interact with,"





he observes. Although robots or artificial characters on a screen – so-called avatars – do not have real feelings themselves, they trigger emotional reactions in people. And this can be used, for example, to design better

user interfaces. This new discipline is called robotic user interfaces, and the objective behind it is not to build robots and avatars that resemble people, but to develop synthetic creations that can bridge the gap between ►

*Artificial creatures that display feelings – such as robot Mexi shown here, cute characters for chat rooms (figure to the left) and Japanese creations (figure on the next page) – can make interaction with machines much easier. Bilder: Siemens*

|                        |  |
|------------------------|--|
| <i>acquire, to</i>     | <i>sich aneignen</i>                       |
| <i>artificial</i>      | <i>künstlich</i>                           |
| <i>assumption</i>      | <i>Annahme</i>                             |
| <i>attribute</i>       | <i>Eigenschaft</i>                         |
| <i>beam, to</i>        | <i>strahlen</i>                            |
| <i>blackmail, to</i>   | <i>erpressen</i>                           |
| <i>concoction</i>      | <i>Gemisch</i>                             |
| <i>conduct, to</i>     | <i>durchführen</i>                         |
| <i>cord</i>            | <i>Kordel</i>                              |
| <i>cringe, to</i>      | <i>zurückschrecken,<br/>zusammenzucken</i> |
| <i>curious</i>         | <i>neugierig</i>                           |
| <i>distinguish, to</i> | <i>unterscheiden</i>                       |
| <i>endearing</i>       | <i>liebenswert</i>                         |
| <i>fellow</i>          | <i>Kerl</i>                                |

|                         |                        |
|-------------------------|------------------------|
| <i>gap</i>              | <i>Kluft, Lücke</i>    |
| <i>gaze, to</i>         | <i>starren</i>         |
| <i>genuine</i>          | <i>echt</i>            |
| <i>goal</i>             | <i>Ziel</i>            |
| <i>handlers</i>         | <i>Bediener</i>        |
| <i>jointly</i>          | <i>gemeinsam</i>       |
| <i>neglect, to</i>      | <i>vernachlässigen</i> |
| <i>perk up, to</i>      | <i>spitzen</i>         |
| <i>proceed from, to</i> | <i>herrühren</i>       |
| <i>protrude, to</i>     | <i>hervorstehen</i>    |
| <i>resemble, to</i>     | <i>ähneln</i>          |
| <i>successor</i>        | <i>Nachfolger</i>      |
| <i>tinny</i>            | <i>blechern</i>        |
| <i>trigger, to</i>      | <i>auslösen</i>        |
| <i>wane, to</i>         | <i>schwinden</i>       |

human needs and the information present in the computer world. Kleinjohann imagines future information kiosks or cash machines that enter into spoken dialog with users through a device that might be similar to Mexi.

Christoph Bartneck of the Eindhoven University of Technology in the Netherlands imagines robot interfaces above all in the entertainment and educational sectors. He believes that robots could also take over the job of controlling an electronic home.

In Japan, where the subject of humanoid robots is viewed with far fewer *inhibitions* than almost anywhere else, domestic helpers of this kind are already highly popular. One example is the R100 from NEC, which looks like a miniature version of R2D2 from Star Wars. This monitor-based creation can read e-mails out loud for its owner and control the television and video recorder. But Kleinjohann believes that a physical *implementation* such as Mexi is more *credible* and therefore superior to a computer-screen avatar. "The PC with a screen isn't the terminal of the future," he says.

## Friendly Faces

But ease of use can be *enhanced* with the personal computer as well. Dr. Stefan Schoen, head of the User Interface Design department at Siemens Corporate Technology (CT) in Munich, Germany, *emphasizes* that finding the right mixture of user friendliness and attractiveness is *crucial* to the acceptance of user interfaces in PCs and PDAs. The attract-

iveness factor has a big influence on subjective first impressions, and therefore on sales.

The same is true for voice-response systems. A friendly computer voice is interpreted as more helpful than a neutral or unfriendly one. Feelings can therefore be *deliberately* manipulated on a *subliminal* level. However, it is important that the interaction remain controllable, Schoen says. Although a machine may *arouse* emotions in people, it should not become unpredictable and irritate users with its own moods – like the depressive robot Marvin in Douglas Adams' novel *The Hitchhiker's Guide to the Galaxy*. Things can also *backfire* if an avatar acts too much like a person, since that might create expectations that the artificial creature cannot possibly fulfill. "Abstract gestures like pointing or head scratching when the computer is looking for an answer are very effective," notes Dr. Bernhard Kämmerer, who is responsible for interaction technologies at Siemens CT. In principle, that also applies to Clippit, which pops up to offer help texts in Microsoft programs. Nevertheless, the virtual paperclip doesn't *go down well*, because it appears without being *invoked*, says Stefan Schoen. "Many users feel controlled by Clippit," he says.

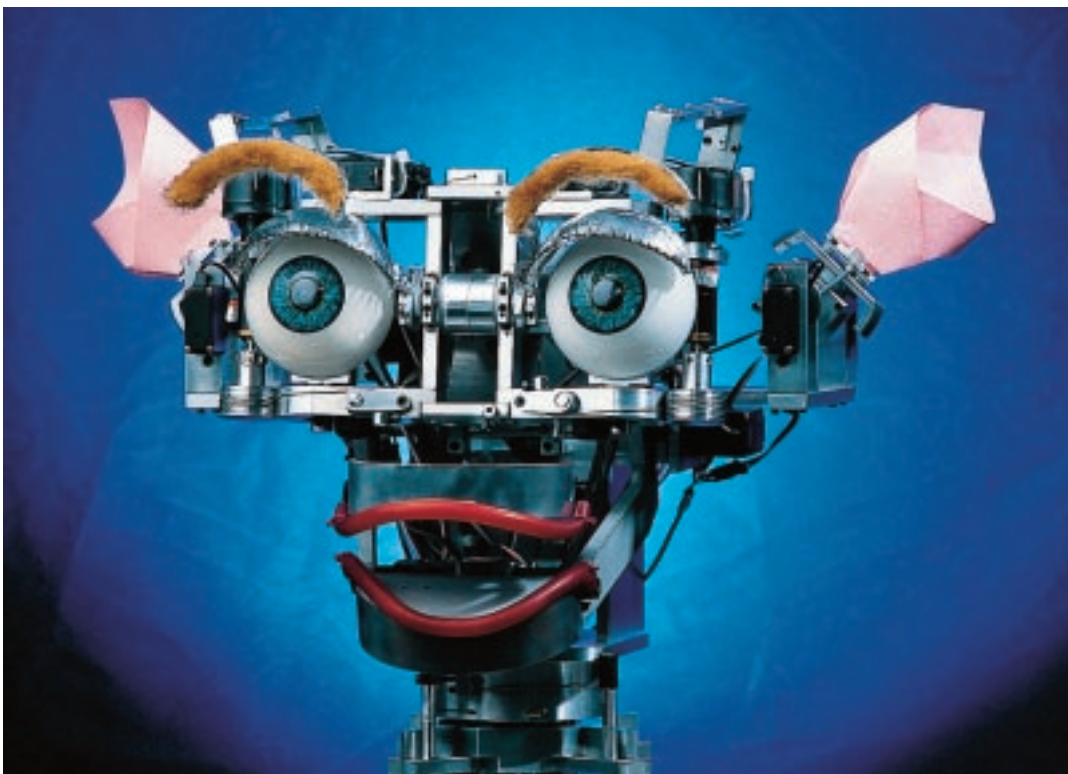
Schoen's colleague Heinz Bergmeier is currently developing avatars for a future UMTS chat application. The new generation of figures resemble amusing cartoon characters and can *depict* the feelings of chat participants on a cell phone display. These figures work in much the same way as the *emoticons* that many cell phone users like to use in SMS.

Instead of faces produced from symbols, such as :- ) or :-( , a mobile chat can use humorous characters such as penguins or tortoises that act as avatars and smile or *pout* in a virtual chatroom. Using a slide control, the user can select from up to 13 different emotional states to transfer to his or her cell phone partner's phone. If the participants like each other, they can even go into a private room and have the penguin and the tortoise kiss by pressing a button.

## The Sound of Anger

Obviously, it is easy to *call forth* emotional reactions in people. A *yapping* plastic dog like Sony's toy robot Aibo or a cartoon character on a cell phone display are all it takes. But could the reverse be true? Would it be possible for machines to recognize and use emo-





*Kismet, Mexi's brother, was created at the Artificial Intelligence Laboratory at the Massachusetts Institute of Technology in Boston.*

tions? To date, *achievements* in this area have been *modest*. Researchers at the University of Munich have used a computer to interpret 80 percent of human gestures, but the number of gestures was small and they were performed by actors.

For Professor Harald Höge of the Interaction Technologies Department at Siemens CT in Munich, what is particularly interesting is how emotions are expressed in speech. In the future, says Höge, the voice response systems frequently used by call centers for *preliminary* customer guidance will put a caller through to a flesh-and-blood staff member immediately if they determine that the caller is angry. But this will not happen in the near future.

"The most effective thing would be to *tap right into* the brain to determine a person's feelings," says Dr. Martin Stetter of the Neurocomputing Center at Siemens CT. Stetter is developing a brain-computer interface that senses simple emotional states by means of electroencephalograms.

Indeed, certain brainwaves are very reliable indicators of fright, relaxation or tiredness. This means that a cap fitted with sensors could be used to measure the effect user interfaces have on test subjects. The technology could, for instance, be adapted to automotive safety systems that would sound an alarm if the driver started *dozing off*.

## Brain Piercing

In animal tests, monkeys have learned to control a robotic arm with the power of their thoughts. To do so, however, a team led by Johan Wessberg from Duke University in Durham, North Carolina, had to implant

electrodes in the brains of the test animals. Taking these thoughts a step further, Stetter believes that it may eventually be possible to transmit simple feelings from one individual's brain to another or even to a robot *by means of* what he calls brain piercing. Nevertheless, even he doesn't believe that the entire *gamut* of a person's thoughts and emotions will ever be transmitted in this manner: "That's pure science fiction," he says. ■

|                         |  |
|-------------------------|--|
| <i>achievement</i>      | <i>Leistung (was man erreicht hat)</i>     |
| <i>arouse, to</i>       | <i>wecken, anregen</i>                     |
| <i>backfire, to</i>     | <i>ins Auge gehen, fehlschlagen</i>        |
| <i>by means of</i>      | <i>durch, mittels</i>                      |
| <i>call forth, to</i>   | <i>hervorrufen</i>                         |
| <i>credible</i>         | <i>glaubwürdig</i>                         |
| <i>crucial</i>          | <i>entscheidend</i>                        |
| <i>deliberately</i>     | <i>absichtlich</i>                         |
| <i>depict, to</i>       | <i>(bildlich) darstellen</i>               |
| <i>doze off, to</i>     | <i>einnicken</i>                           |
| <i>emoticons</i>        | <i>Kunstwort aus emotion und icon</i>      |
| <i>emphasize, to</i>    | <i>betonen</i>                             |
| <i>enhance, to</i>      | <i>verbessern</i>                          |
| <i>gamut</i>            | <i>Vielfalt</i>                            |
| <i>go down well, to</i> | <i>gut ankommen, Anklang finden</i>        |
| <i>implementation</i>   | <i>Ausführung</i>                          |
| <i>inhibition</i>       | <i>Hemmungen</i>                           |
| <i>invoke, to</i>       | <i>abfragen, hervorrufen</i>               |
| <i>modest</i>           | <i>mäßig, bescheiden</i>                   |
| <i>pout, to</i>         | <i>die Lippen schürzen</i>                 |
| <i>preliminary</i>      | <i>Anfangs, -, Vor, -</i>                  |
| <i>subliminal</i>       | <i>im Unterbewusstsein, unterschwellig</i> |
| <i>tap into, to</i>     | <i>anzapfen</i>                            |
| <i>yapping</i>          | <i>kläffend</i>                            |

Der Roboter Mexi ist eine Entwicklung des C-Lab, einem gemeinsamen Forschungslabor von Siemens und der Uni Paderborn.

Mehr über Mexi und andere Projekte im Bereich Computer und Kommunikation erfahren Sie unter [www.c-lab.de](http://www.c-lab.de)

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