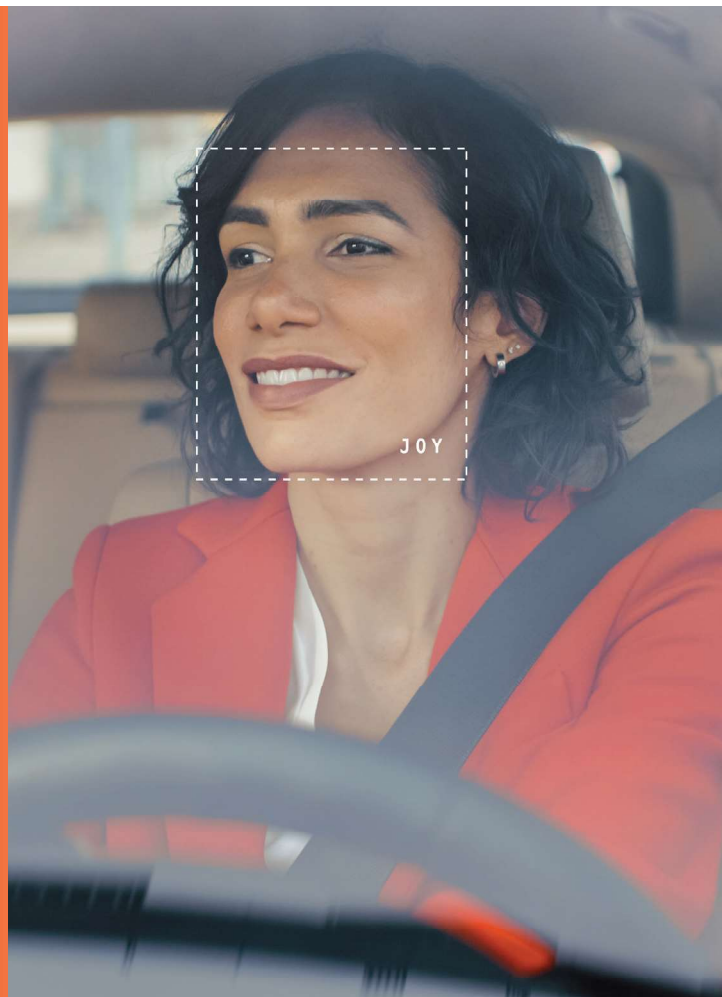# DESIGNING AI THAT KNOWS HOW YOU FEEL

It's a bright April day in Boston, and Gabi Zijderveld, a pioneer in the field of emotional artificial intelligence, is trying to explain why teaching robots to feel is as important as teaching them to think.

"We live in a world surrounded by all these super-advanced technologies, hyper-connected devices, AI systems with super cognitive abilities — or, as I like to say, lots of IQ but absolutely no EQ," says Zijderveld, chief marketing officer of Affectiva, the startup that spun out of the MIT Media Lab 10 years ago to build emotionally intelligent machines. "Just like humans that are successful in business and in life — they have high emotional intelligence and social skills — we should expect the same with technology, especially for these technologies that are designed to interact with humans."

Giving machines a soul has been a dream of scientists, and sci-fi writers, for decades. But until recently, the idea of robots with heart was the stuff of moviemaking. Not reality.

Now, however, companies like Affectiva are on the verge of creating a new world of machines that can feel, or at least understand how we feel.

The power to detect human emotion on a mass scale has implications for every aspect of society — from business to politics to education to medicine. Already, the technology is being leveraged by advertisers to understand how consumers feel about their products. Car manufacturers are looking to incorporate the technology in self-driving vehicles. Medical researchers are testing its applications for treating mental health and neurological disorders. And this is just the beginning.

WHY FACIAL EXPRESSIONS MATTER

Last spring, a team from Ohio State University claimed its AI system could identify certain expressions of happiness in human faces with more accuracy than, well, humans.

Thanks to advances in computing power, big data and deep learning, machines that can accurately assess, and one day predict, emotion are within reach.

Affectiva and its technology are part of this larger movement, teaching feelings to robots, which is also teaching us a lot about our own emotions. The company was founded in 2009 by MIT professor Rosalind Picard and research scientist Rana el Kaliouby, who is now CEO. At Affectiva, el Kaliouby and her team have created a database of more than 8 million faces from 87 countries recorded expressing just about every emotion humanly possible. (The company says all participants in Affectiva's database consented to be recorded.)

The sheer size and range of the database allow the algorithms to detect patterns in facial movement that indicate nuances in emotion, such as the difference between a smirk and a smile. The diversity of faces in its database works to eliminate algorithmic biases and pick up the differences in expressions of people of all ethnicities, ages, genders and cultural backgrounds. For example, in the United States, women are collectively much more emotionally expressive than men. In the United Kingdom, men and women are more similar in how they show emotion.

8,333,646

faces analyzed in 87 countries around the world to create a

DATABASE OF
HUMAN EMOTION

One emotion that has been particularly tough to train algorithms to detect is frustration. People often express it using contradictory or unexpected gestures. "Frustration can manifest itself as laughter," observes Zijderveld. To solve this problem, Affectiva is now training its algorithms to connect vocal cues with facial movement and in this way better understand the complexities of human emotions.

This has the potential to improve the quality of interaction with digital assistants and customer service bots. Instead of ignoring a customer's frustration, they would be able to empathize and respond in a more human way, perhaps saving a sale or de-escalating a problem. So in the not-

MAPPING EXPRESSIVENESS:

How human emotion varies around the world

In the U.S.,
WOMEN'S FACES TEND TO BE MORE EMOTIONALLY EXPRESSIVE THAN MEN'S.

In the U.K.,
MEN AND WOMEN ARE MORE SIMILAR IN HOW THEY EXPRESS FEELINGS.

too-distant future, when you snap at your phone's voice assistant, not only will she know it but she might also be trying to figure out how to improve your mood.

"We are on a mission to fuse the digital world — or to fuse technology — with the ability to understand humans that are interacting with it," says Zijderveld. She and el Kaliouby are credited with inventing the term (and hashtag) "emotion AI" in 2016 at an industry conference. Together they have helped define it as a business category.

DOES YOUR AD MAKE PEOPLE LAUGH? OR SMIRK?

For now, Affectiva's biggest customers are market researchers working with big advertisers, from food manufacturers to media corporations, that use its cloud-based emotion recognition software, Affdex, which culls from a database of 40,000 ads and millions of faces to measure seven emotions and 20 facial expressions. It can filter analyses by demographic and other data.

For example, one major TV network used the technology to measure audiences' emotional responses to one of its primetime dramas. Using a focus group of 200 viewers watching the show while being recorded on a webcam, Affdex tracked their facial movements, frame by frame, and was able to pinpoint scenes and moments where people connected with the show emotionally. This in turn helped the network gain insight into its audience and evaluate how to further engage them and position TV promos and ads. This kind of intel could be used to guide story flow, media spend and even the personality and prominence of TV characters.

A candy manufacturer used Affectiva's software to understand the emotional responses its ads produced in viewers — and to determine whether this could help predict sales. The technology recorded data on more than 1,500 participants watching 200 ads (also by webcam). As a result, the company learned that people have higher emotional engagement with chocolate than with other foods.

The potential here reaches far beyond advertising. Affectiva conducted a study to test its technology's ability to detect emotional reactions to political debates. In it, the company

recorded the faces of volunteers watching two candidates spar over issues and measured their reactions to the rhetoric in real time. The software successfully identified moments when candidates either won or lost points with viewers and the strong responses that their rhetoric could evoke. For example, when one candidate attacked the other about his position on the military, it elicited a spike in smirks among the viewers.

CARS THAT BACKSEAT DRIVE

In April, Affectiva raised $26 million to build what it sees as its next major market: emotion AI for cars. As auto manufacturers race to build self-driving vehicles of the future, the company is betting that its technology could play a role in shaping this new world of transportation. At the Consumer Electronics Show in January, one auto manufacturer used Affectiva's technology to demonstrate ways that cars could use AI to analyze drivers' feelings and adjust things like temperature, sound, light and scent inside the vehicle. In the future, if all goes as planned, emotion AI in cars could help calm us down, wake us up and get us mentally ready for the day's commute or a big night out. Affectiva, which already has contracts with auto-makers

and suppliers, hopes to have its technology embedded in cars on the road by 2021.

Affectiva's technology is evolving fast. A promising new frontier is a developing field called "human perception AI." Zijderveld describes this next phase as "technology that can understand all things human." Going beyond detecting just emotion, computers will be able to detect complex cognitive states such as drowsiness and distraction, which will only broaden the applications within the realm of the auto industry.

Now computers can infer that a person is distracted by her eyes looking down, for example. It would not know whether she is looking at her phone or texting or looking at someone else. In cars, an AI system that could understand these nuances might be able to anticipate how to keep drivers focused. Or in an autonomous vehicle, it could know whether a passenger is spending the trip working and therefore in need of quiet or getting ready for a road trip and in the mood for music.

With human perception AI, Affectiva is looking at ways to train its algorithms to understand not only how people feel internally but also how they interact with their environments, objects and other people — which has potential across industries.

Two other major markets the company aims to move into are healthcare and education. Already, pharmaceutical companies are looking at leveraging emotion AI to improve clinical trials by monitoring mood changes caused by medication. Medical researchers are deploying its ability to detect minute facial movements to hunt for early signs of Parkinson's. Others are using it to teach children with autism how to identify emotions and nonverbal cues.

THE ETHICS OF EMOTION AI

The question, of course, for humans is what will all this bode? For businesses and brands looking for ways to connect with global consumers in a more personal, in-depth and efficient manner, the opportunities here are many.

Human emotions are complex, elusive and constantly changing. In many ways, AI and machine learning have the potential to

UNDERSTAND THEM BETTER THAN ACTUAL PEOPLE DO.

Zijderveld's vision of the future is one in which machines can help us understand ourselves and our feelings and, ultimately, make us happier. So if you wake up feeling stressed, imagine if your digital assistant could sense it and already started playing your favorite meditation app, ordered you a chai latte and scheduled a yoga class.

Still, it's hard not to succumb to scary visions of super-sentient machines taking over humanity. For Affectiva, the issue is top of mind. When approached by a business that wanted to use its technology to monitor people without their consent, Zijderveld says, Affectiva turned down the deal because the team was worried about misuse. "Especially in situations where there is surveillance and people are being monitored without knowing," she says, "we have actively walked away from business opportunities that we felt [were] in violation of our stance on what we think is ethical deployment of our AI."

As Affectiva's technology and other machines learn to delve into the innermost feelings of humans, it is also critical to raise the question of ethics as it applies to this new form of AI. Who owns the data reading people's feelings? How will consumers be able to protect their privacy? Will bad actors use it to spy or manipulate, as they have with social media and other technologies?

We may not have all the answers here. Still, as intelligent machines radically reshape just about every aspect of our world, it is important to keep asking questions. Like every technological revolution in history — from the printing press to atomic power — emotion AI can bring both good and bad into the world. It will be up to humanity — not machines — to tip the balance in the right direction. ▪