Tim: Take this section from James Martin tape

USA Today reports artificial intelligence is being used by airlines to help pilots land planes in fog. The U.S. military used artificial intelligence during Desert Storm in the early 1990s to help guide missiles to their targets. Automatic brake systems on cars and voice recognition software on corporate and personal computers all use forms of computer intelligence.

Catalog Age, a trade magazine, reports that a cataloger outsourced certain telephone functions to a company with sophisticated voice recognition technology, which was able to do some of the functions customer service representatives had done. The resulting drop in costs to the cataloger were dramatic. The cost per request for a catalog dropped from about $1.25 per call to 50 to 75 cents. The cost of calls related to the status of orders were cut in half, from $1.50 to 75 cents.

What Are We Talking About? Some Definitions

There's evidence of artificial intelligence folklore dating back to ancient Egypt, but it wasn't until the development of the electronic computer in the early 1940s that machine intelligence became truly possible.

Despite the fact the concept of computer intelligence has been kicking around for so long, it's still hard to pin down exactly what is meant by this term. Think of it as an attempt to mimic the way human beings think and make decisions. Joel Siegal, a professor of accounting and information systems at Queens College, which is part of the City University of New York, and a co-author of The Artificial Intelligence Handbook, says artificial intelligence is using machines to conduct complex tasks and do analysis, reasoning, learning and communicating.

James Martin goes further with his concept of alien intelligence. James, how would you define alien intelligence?

Tim: Take this section from James Martin tape: Some people are trying to make computers like people. That's a feeling of comfort. But what goes on underneath is not going to be anything like human intelligence. That's a great myth. Etc.

Computer intelligence today focuses primarily on two technologies, neural networks and expert systems. Let's look at these in some depth.

Neural Networks

Neural networks are programs that, in effect, program themselves based on actual observations. They create their own intelligence, in a manner of speaking, by learning from real world phenomena.

One short coming of neural networks is that, because they train themselves, people often have no idea of how they came to the conclusions they do. John Walker, a colleague of Siegal at Queens College, calls neural networks a black box type system because you observe a process and you

know that these inputs go in and you see these outputs coming out but you don't how necessarily how the outputs came about. This is why neural networks could be considered forerunners of James' alien intelligence.

Sounds other worldly? In fact, neural networks are in use today in a wide variety of businesses. Because they are so adept at identifying patterns, they are used by banks to detect fraud, by retailers to cross sell, help with customer relationship management, predict failures of machinery, handwriting recognition and biometric identification, voice recognition and in data mining.

In James' book, he talks about how Twentieth Century Fox uses neural networks to sift through millions of box office receipts and predict what actors, plots, and films will be popular in each neighborhood. By avoiding flops in specific theaters, the company saves about $100 million worldwide each year. The same technology, he says, could select alternate trailers for each movie in different theaters to help maximize sales. One movie may have many differently edited trailers, which appeal in different ways to different audiences.

Westinghouse Process Control, a division of Emerson Process Management, reports it now has plant optimization software based on neural networks, which it calls SmartProcess, that delivers increased efficiency and lower costs.

A recent issue of the publication *Wines & Vines*, had an article about a team of researchers studying wine making who are, and to use their words, hoping that artificial neural networks will be able to predict fermentation kinetics based on grape juice characteristics and the intended processing. Neural networks, they say, can also be useful for even achieving a type of style for example. Their example? A tropical wine with hints of honeysuckle. And who said technology was only for nerds?

Benefits of Neural Networks

Why be interested in neural networks? They save time by detecting patterns in databases it would take humans much longer to decern. In fact, neural networks are capable of detecting patterns that no amount of human effort could detect, because the data is so complex and contains so many possibilities. Datamining is an area where pattern recognition is essential. Often, the databases used are so large that a person really doesn't have much chance of mining it in a fully useful way.

The fact that neural networks teach themselves based on observations means you don't have to constantly program them. Which produces another benefit, namely that they can adapt to constantly changing environments.

Given these benefits, you can probably guess where neural networks are best used, namely in constantly changing environments. If you're a doctor looking for a system that can help you diagnose disease, you probably wouldn't rely on a neural network. That's because disease symptoms tend to remain constant over time. How cancer or circulatory problems manifest

themselves don't change much over time. For this use, you'd probably want to use another type of computer intelligence technology called an expert system, which we'll discuss shortly.

But, say, you're a tax preparer and want an automated system to deal with the tax code. The Internal Revenue Service, bless its heart, is constantly changing the tax code. The IRS creates an environment as solid as shifting sand. For this type of situation, neural networks can be highly effective.

They do have their shortcomings. They can be difficult and costly to set up. They need to feed on lots and lots of data. After all, that's how they learn and improve their performance. While they are good at adapting to constantly changing information, they may take some time to learn what to do when there's a sudden change.

Perhaps the greatest shortcoming of neural networks is, they operate in ways we don't understand. They will come up with recommendations and insights that may be very true and very valuable, but we don't know how they came up with what they do. It therefore takes some time for the technology to gain the confidence of users.

This hidden way of operating means it is difficult to extract rules from neural networks. And if the network is learning from inaccurate data or date inappropriate to the situation, the results you get will be poor, or even misleading. It's the old adage, garbage in, garbage out.

The other widely used computer intelligence technology is expert systems, which we'll now discuss.

Expert Systems

Expert systems, though also a form of computer intelligence, are easier to grasp than neural networks. Just think of this technology as an expert in a box. Put the expert's knowledge into a computer as a series of rules and you have an expert system. One of the best known examples of the power of expert systems was the defeat of chess grandmaster Kasparov by IBM's Deep Blue in 1997. The machine was programmed using the knowledge of a team of chess experts, and during the series of matches, the program was modified during each night by this team to reflect new information gained from that day's chess game.

Expert systems make decisions by applying a set of rules which reflect the knowledge of people (or experts) who would otherwise make the decision. Expert systems are good for applications with logical separators between decision-influencing factors. Since they have explicit rules, it is easy to understand how their decisions are made, unlike the decisions made by neural networks.

The situations where expert systems are used include help desk, insurance underwriting, determining eligibility for government benefits, product configuration and scheduling, automated trading on the financial markets, airline yield management systems, managing the power grid, insurance underwriting, moving cargo and even to some extent, weather forecasting.

Manufacturing is another area of use. As an illustration, specifications for a product can be fed into the production machinery and integrated into sensors that monitor the production process. After an operation is completed, the sensor will feed information back into the expert system about how well the operation was performed. If there's a problem, the expert system can adjust the movement of the machine or robot to assure the end product is within specifications. Expert systems, according to John Walker, have been one of the major factors in increasing labor productivity in the United States because there's fewer bad parts so the productivity goes up for the same workforce.

Walker gives the following example of an expert system, in this case one that does medical diagnostics. First is to have the medical practitioner go through a series of questions: What is the person's temperature, pallor of his skin, blood pressure, is there a coating on the tongue, is there any inflamation, etc. Using an inference engine, it identifies where in the database you should be searching to get a match. The questions change based on the responses given, which is why this is considered computer intelligence. In other words, not every one is asked the same questions. If blood pressure is high, for instance, it might ask a different follow-up question than if blood pressure is normal. And a different follow-up question might be asked if blood pressure is low. When the system provides a diagnosis, it might say there's a 10 percent chance the patient has this, 30 percent chance of that and 60 percent chance of something else. Theoretically, says Walker, doctors have been trained to make these diagnosis for the hundreds of thousands of illnesses that exist, but in reality, for a doctor to be able to go through all this might be extremely time consuming particularly if there are very usual symptoms. That's where they've had a lot of success with expert systems in the medical field.

But expert systems are difficult to build because the rules don't always exist and the "expert" information is difficult to acquire. Often the experts don't exist or they cannot communicate accurately how they weigh various factors to reach a conclusion. And once an expert system has been programmed, it cannot be adapted easily to changing conditions.

To appreciate the difficulty of translating an expert's expertise into definable chunks of information which can be programmed into a computer, think about yourself as an automobile driver. Likely, you've been driving for years, probably decades. You are, in fact, an expert at driving. Imagine trying to write down in discrete steps all you've learned about driving over the years. Your first attempt would probably not be much different than a novice driver who just completed driver's education – you'd provide the basics. But you know so much more than the novice. During the time you've driven, you've had hundreds, even thousands, of experiences that make you an expert. For example, you can quickly identify an erratic driver whom you want to avoid -- and you know how to avoid that person. You know what it's like to drive on wet and snow-covered roads. But these experiences might have occurred only a handful of times, making them hard to recall when you are first asked to describe how to drive a car. It is this depth of knowledge that largely separates you from the novice. Capturing this depth of knowledge is the tricky part, and is why creating effective expert systems is so tough.

Expert systems may also require a lot of computing power because these systems often consist of very large databases which must be searched before an answer to a question is found. And as

with virtually any computer system, if it is programmed poorly or has incomplete or inaccurate information, its results will be flawed.

Alien Intelligence

TIM: In this section, I figure you'll just take bits and pieces of the Martin interview and edit them into a coherent whole.

We are fortunate to have the world's leading expert on one of the most promising computer intelligence technologies on this program, namely James Martin. What do you think is the problem with conventional computer intelligence and why do you think alien intelligence is the most promising type of computer intelligence we have?

MARTIN: He talks about how developers of conventional computer intelligence try to make the computer think rationally. They do that for the feeling of comfort but its not very practical because computers will never think like people. Then let him talk about how alien intelligence will be able to ferret out information and patterns from databases that humans never could. And how the human mind is best suited for subtle things, while alien intelligence has value precisely because it involves thinking in non-human ways. The benefit: it will totally change how we run corporations and will change mankind, Martin says. We will gain insights into our businesses we don't have now. You can use his mention of the Ford/Firestone fiasco.

A Couple of Other Forms of Computer Intelligence

Neural networks and expert systems are the most common forms of computer intelligence used today, while alien intelligence is arguably the most promising when we look into the future. But there are some other computer intelligence techniques worth mentioning briefly. The most notable of these is fuzzy set theory, which has been around for quite some time. Fuzzy sets are just that – fuzzy, not definite. Walker makes the observation that whereas the expert system will say, 'If you do this you'll be right 60 percent of the time,' the fuzzy set says, 'If you do this, you'll be right 60 percent of the time but this could happen and that could happen. Walker believes that fuzzy sets aren't more popular because managers are looking for more definitive answers than fuzzy logic provides.

According to Bakalov, fuzzy logic is mainly used in embedded control applications, such as cameras, washing machines, aircraft engines. It is rarely used in enterprise applications. It helps a system make a decision when things are not black and white. It makes its decisions based on probability. Fuzzy set theory is usually used in conjunction with other computer intelligence technologies rather than by itself.

Another form of computer intelligence worth mention is genetic algorithms. Genetic algorithms optimize solutions by using the principles of natural selection and genetics. They are an optimization technique, not a solution on their own. They use the principle of natural selection and are best used when repeating the same result many, many times with minute variations. The reason we evolve and the reason we change is because there are always minute differences in genes and the genes are driving the changes, driving the natural selection. As there are slight

changes, it reacts and finds the optimum solutions. Examples of using genetic algorithms are when seeking shipping solutions or doing pharmaceutical research.

Action Plan

What do you do with all this information about computer intelligence? Here are some things consider:

1. There are canned, off-the-shelf programs, but don't expect them to be effective without considerable customization.
2. There's the cost. Siegal estimates the costs for a computer intelligence system may go as low as $5,000, but on the up side, they run into six figures.
3. Alien intelligence may seem far fetched, but sophisticated corporations can begin studying it and implementing it today. James Martin recommends establishing a laboratory within your organization to study alien intelligence.
4. Computer intelligence is not for every situation. Siegal notes that the most effective situations for using computer intelligence are those which are recurring and have a pattern to them. Not suitable are situations where something that doesn't occur except in an isolated situation, where there's a lack of consistency.

Conclusion

Wanda is cute but obviously not real. Computer intelligence, including neural networks, expert systems and alien intelligence, are real, are here today and can help you lift your company onto a higher level of success. If you've set up your systems well, these results will provide you with a wealth of insights and advice that can propel your company onto the fast track of growth and success.