ELLIOTT PRECHTER
EWAVES Flash
Published by Qualitative Analytics

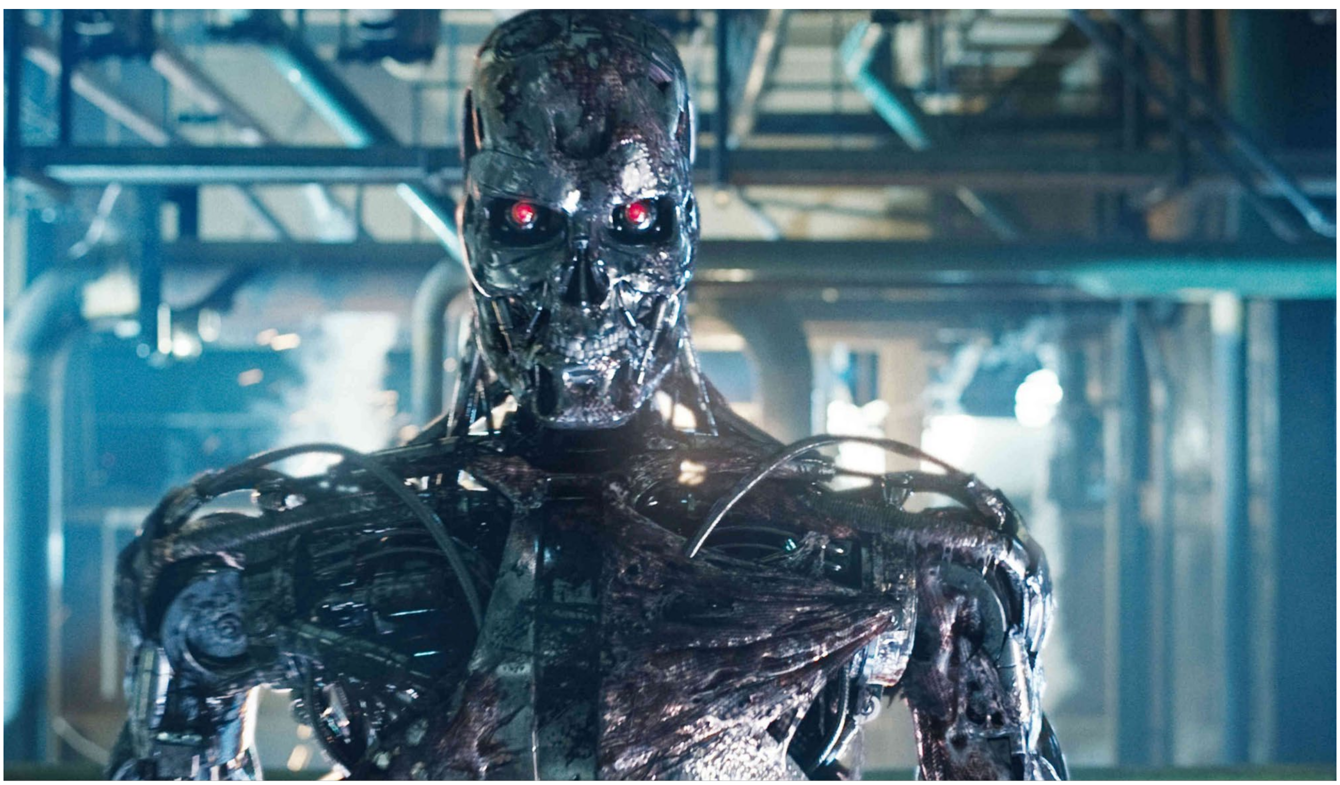
October 2015 Issue
© October 22, 2015

THE ELLIOTT WAVE GRANDMASTER

Since the inaugural issue of *EWAVES Flash*, we have consistently referred to EWAVES as an artificially intelligent program. But what exactly is artificial intelligence (AI) anyway? What criteria separates "normal" software from that which exhibits intelligent behavior?

Unfortunately, there is no consensus definition of AI. Stanford professor John McCarthy (the inventor of the LISP programming language, which we still use in the nearly retired EWAVES 1.1) coined the term in 1955 as "the science and technology of making intelligent machines." But he did not precisely define what constitutes intelligence, an issue which remains unresolved to this day. In 2007 he stated, "The problem is that we cannot yet characterize in general what kinds of computational procedures we want to call intelligent. We understand some of the mechanisms of intelligence and not others."[1]

Most people believe that AI implies human-like behavior, perhaps because, historically, intelligence is a trait at which only humans excel. Popular culture reflects the strength of this view, with science fiction AIs routinely anthropomorphized. HAL 9000 from *2001: A Space Odyssey* demonstrates self-interest; Mike from *The Moon is a Harsh Mistress* has a sense of humor; *The Terminator* looks and walks like a human being (but he talks like Arnold Schwarzenegger). In this spirit, perhaps human emulation is what propels otherwise ordinary machinery into the realm of AI.



Terminator Genisys

The Turing Test

As it turns out, one of the oldest theoreticians in machine intelligence made just such a proposal. Alan Turing, a prominent cryptanalyst who broke the German enigma cipher during WWII, described a now-famous test for determining if a program could emulate a human in his 1950 work *Computing Machinery and Intelligence*. In his *Turing test*, a human examiner must interact via a chat terminal with either another human or a chatterbot program, without knowing beforehand which it is. If the chatterbot can fool the examiner into thinking it is a human, then it passes the test. Fooling enough examiners would show the chatterbot to be sufficiently indistinguishable from a human to be classified as intelligent.

At the time, the Turing test seemed like a possible verification of machine intelligence. Its breadth is theoretically unlimited, since interrogators can ask the computer any question they can imagine. And by focusing on the program's external behavior only, it circumvents the need for the program to model actual human thinking processes. This feature resonates with Alan Turing's mechanistic view that "if a machine behaves as intelligently as a human being, then it is as intelligent as a human being" and that "Can machines think?" was "too meaningless [a question] to deserve discussion."

XKCD

In 1966, the Turing test met the ELIZA chatterbot, developed by Joseph Weizenbaum at MIT. Unlike most chatterbots which relied on a massive databases of pre-written responses to assist in conversation, ELIZA was simple and had a limited database. But it had a secret weapon inspired by psychotherapy. The trick was to try to turn the user's statements into questions. By acting like a therapist, it cleverly allowed the program to run with limited knowledge yet appear to be a real human being. Apparently this was enough to fool many to believe they were talking to a real person, such as the following woman:

woman: Men are all alike.
eliza: In what way?
woman: They're always bugging us about something specific or other.
eliza: Can you think of a specific example?
woman: Well, my boyfriend made me come here.
eliza: Your boyfriend made you come here?
woman: He says I'm depressed much of the time.
eliza: I am sorry to hear you are depressed.
woman: It's true. I'm unhappy.
eliza: Do you think coming here will help you not to be unhappy?
woman: I need some help, that much seems certain.
eliza: What would it mean to you if you got some help?
woman: Perhaps I could learn to get along with my mother.
eliza: Tell me more about your family.
woman: My mother takes care of me.
eliza: Who else in your family takes care of you?

woman: My father.
eliza: Your father.
woman: You are like my father in some ways.
eliza: What resemblance do you see?
woman: You are not very aggressive but I think you don't want me to notice that.
eliza: What makes you think I am not very aggressive?
woman: You don't argue with me.
eliza: Why do you think I don't argue with you?
woman: You are afraid of me.
eliza: Does it please you to believe I am afraid of you?
woman: My father is afraid of everybody.
eliza: What else comes to mind when you think of your father?
woman: Bullies.
eliza: Does that have anything to do with the fact that your boyfriend made you come here?[2]

ELIZA blew the Turing test out of the water. It wasn't so much just that it fooled so many examiners, it was that it did so despite being so unprofound. The software relied on simplistic pattern matching rather than anything even remotely resembling a thinking mind. ELIZA's success, as well as that of subsequent, more advanced yet similarly non-thinking chatterbots, caused many researchers to reconsider the utility of the Turing test as a standard for AI.

Benedict Cumberbatch playing Alan Turing in "The Imitation Game"

Later on, a deeper problem with the Turing test became known: the importance of artificial stupidity. This concept first emerged during the annual Loebner prize competition, which since 1991 has allowed chatterbot creators to compete against one another in Turing tests. During trials, it rapidly became apparent amongst competitors that their chatterbots appeared less human to judges when they did not error. To fool the judges, they actually forced their programs to make mistakes. Of course, if purposeful stupidity is a requirement for a proof of intelligence, then that is a contradiction. Stupidity may be human, but it is not a factor in intelligence. Therefore, human emulation cannot be what defines AI, or at least not wholly.

Intelligence as Complexity

The most immediately useful AI research to date has actually not centered on passing the Turing test. Instead, many in the research community have focused on modeling narrow areas of what they proposed to be intelligent behavior. This has usually meant inventing algorithms to handle extremely complex problems that were beforehand thought to be the exclusive domain of human beings.

An excellent example is chess. For years, there was no obvious way to "solve" chess. The game is both sophisticated and dynamic, requiring each player to constantly adjust their strategy based on the other's moves, attempting to maximize their chances for a checkmate.

Due to its complexity, chess was human-dominated for decades despite continuous research—beginning with Alan Turing himself—into chess playing AIs.[3] But that situation changed in 1997, when IBM pit its Deep Blue supercomputer against then-world-champion Garry Kasparov.

Kasparov wasn't just a grandmaster (the highest title a chess player can attain). He was so good that he had never lost a match, and was widely regarded as the best chess player in history. He had even defeated a previous version of Deep Blue, telling the press, "It's just a machine. Machines are stupid."

But IBM was strangely confident this time. Before the first chess piece was moved, CEO Louis Gerstner joked, "What we have is the world's best chess player vs Garry Kasparov."[4]

The two remained tied throughout the match, until the final game when the machine came up victorious. Kasparov didn't take it well. He was dumbfounded, saying that he sometimes saw "deep intelligence and creativity in the machine's moves." He publicly accused IBM of cheating, believing the machine must have been aided by human grandmasters. The IBM team responded with:

> It's definitely a mistake for Garry to give a position to any other computer and say "This is computer behavior" and "this is what Deep Blue must be thinking." I think he's seen from the games that he's played against Deep Blue, that Deep Blue is no ordinary computer. Deep Blue plays on an entirely different level from any other computer he's seen. Maybe he should come to grips with the fact that Deep Blue can do a lot of things that he did not think were possible.[5]

The machine logs were released after the match, proving that the computer acted alone.

Deep Blue vs Garry Kasparov, 1997

Fast forward to today, and there is no longer any doubt of machine superiority over man on the chessboard. Even regular desktop computers running chess-bots routinely crush human opponents. Within the limited context of chess, these programs no doubt exhibit super-human abilities. But it's hard to classify them as intelligent per se, for several reasons:

First of all, declaring chess-playing sufficiently complex to require intelligence is arbitrary. Just to bring this point to its logical conclusion through reduction to absurdity, if we instead define the ability to do your taxes as the test of intelligence, then the 1979 invention of VisiCalc—the first spreadsheet program—would qualify. However, no one today would regard VisiCalc running on an old Apple II as an example of an intelligent machine.

VisiCalc, 1979

Second, the more that chess-bot construction becomes clarified over time, the more formulaic they appear. This point of view, in fact, permeates the entire history of AI. Many past problems considered to be in the realm of AI lost this distinction when they became sufficiently well solved. In this vein, much of what people call AI could probably be re-classified as merely the current frontier of perplexing computational problems.[6]

Finally, the internal design of chess-bots aren't highly adaptable. Deep Blue can play chess at a grandmaster level, but it can't recognize a dog in a picture. Nor do its components shed light onto how one would go about doing that. Nor can it opt out of playing chess or teach itself to play bridge. The issue is that AI researchers sometimes use radically different approaches for different problems. They have yet to form a unified theory.[7]

It Takes Two

It should be apparent by now that the term AI can be divided into at least two major categories. It's a broad field that subsumes both the "complex problem" definition and the "human emulation" definition. In modern times, these are termed *applied AI* and *strong AI*, respectively.

Applied AI consists of a slew of techniques adaptable for specific problems, whereas strong AI is concerned with generalized intelligence. The immense scope of strong AI extends far beyond just passing the Turing test: It's the Holy Grail, capable of performing any mental task a human can, if not more. In other words, if applied AI is Deep Blue, then strong AI is Data, the android from *Star Trek*.

For now, strong AI is only theoretical. Scenarios involving androids taking over Earth are safely confined to the movie theatres. Whether we classify Deep Blue as intelligent or not is largely academic. Either way, it does not take away from its efficacy on the chessboard. And of course, apart from chess, applied AI has many other triumphs, including speech recognition (we now regularly talk to our smartphones), natural language processing (as demonstrated by the *Watson* machine that won jeopardy), facial recognition, music composition, video game bots, procedural animation, theorem proving, and much more.

Where EWAVES Fits In

With EWAVES 2, we have combined what we believe are the best applied AI techniques possible for the purposes of labeling Elliott waves. Therefore, while we classify it as AI software, it is of course not about to engage anyone in a humorous conversation about cats. But it can count waves—and it will soon do so like a grandmaster.

A lot of EWAVES 2's power comes from the fact that it is a hybrid of different applied AI techniques, so it cannot be pigeonholed into any one category. Specifically, it blends *expert systems* and *machine learning*. Hence the name, **E**lliott **W**ave **A**nalysis & **V**alidation **E**xpert **S**ystem.

Expert systems are explicitly programmed to mimic the decision-making ability of a human expert. They are glass-box, meaning that the reasons for the system's decisions can always be understood by the creators. Machine learning components allow the program to improve automatically through experience. They are black-box, since although the learning mechanisms are well understood, the exact logic that *results* is sometimes difficult to reverse-engineer.

As made clear in the *Lies, Damn Lies and Backtests* issue of *EWAVES Flash* (http://www.ewaves.com/1506ewf), we prefer glass-box approaches, since they allow us to follow the Elliott Wave Principle strictly to avoid the curve-fitting dilemma. But that doesn't mean machine learning cannot be used in a controlled manner. We just have to be certain that the derived logic adheres to R. N. Elliott's model.

Although we have settled on a hybrid approach for now, we are always on the lookout for new ideas. Ideas come both through our own inventiveness and by constantly reviewing the AI literature and seeing if there are any new concepts that we can incorporate. As a result, EWAVES 2 is fluid and indefinitely adapting as we upgrade its design.

It is theoretically possible that one day our wave counting techniques will become so formulaic that the fantasy of machine intelligence will be lost. Until then, the magic show will continue with EWAVES firmly classified as AI. After all, as science fiction author Arthur C. Clarke so eloquently put it, "Any sufficiently advanced technology is indistinguishable from magic."

Q&A: ELLIOTT PRECHTER ON INVESTING WITH ARTIFICIAL INTELLIGENCE

By Socionomics Foundation On March 19, 2015

Developer, programmer and entrepreneur spoke at 5th Annual Social Mood Conference

Elliott Prechter's fascination with technology led him to attend MIT in 2002 and ultimately to join Microsoft in 2006. His interest in financial markets intensified during the 2008 crash, and he left Seattle in early 2011 to help start an algorithmic hedge fund in Las Vegas. In late 2012, he joined Elliott Wave International to develop EWAVES, an artificial intelligence technology that automates Elliott wave analysis. He recently spun the project off into a separate company, Qualitative Analytics. The firm's technology powers Flash, a subscription service that provides real-time buy and sell alerts as opportunities arise in futures and equities markets.

On April 11, Elliott joined a diverse roster of expert speakers at the 2015 Social Mood Conference in Atlanta. Before the conference, Elliott spoke with us about the event, his lifelong interest in technology and some of the latest developments with EWAVES.

Socionomics Foundation: Can you talk about your background and how it shapes your work on EWAVES?

Elliott Prechter: My education at MIT provided me with a theoretical background in hardware and software, and my work at Microsoft exposed me to the practical world of building large projects. Our EWAVES repository is nearing 200,000 lines of code for a team of three developers. Maintaining this repository would not be possible without documentation, design effort, constant re-factoring and, most importantly, extensive test coverage.

SF: Were you always passionate about computers?

Elliott Prechter: For as long as I can remember, I wanted to work with technology. I think my first major obsession in this area was in 3D graphics, which require "pedal-to-the-metal" performance. In fact, it was probably this early fascination with high-octane performance that led me to a design for EWAVES 2 that leverages modern machines far beyond that of EWAVES 1. It has better algorithms, cache-awareness and concurrency. The significantly faster analysis process in EWAVES 2 is allowing us, for the first time, to do the rapid research required to iteratively improve the program.

SF: EWAVES uses the Elliott Wave Principle—and only the Elliott Wave Principle—to generate its analysis. What attracted you to this approach?

Elliott Prechter: It's clear to me that Elliott waves are the only truly robust methodology for financial analysis. All other approaches to market forecasting I have studied either don't work or are transient and eventually burn out. Additionally, as an engineer, I am naturally attracted to solutions with theoretical elegance.

SF: Your work has a thorough research side in addition to its practical side. Would you say a few words about each?

Elliott Prechter: Sure, let's start with the research side. EWAVES distils Elliott wave analysis into a definite and reproducible function, allowing our implementation of the Elliott Wave Principle to be formally researched. This should lead to new discoveries and ultimately better products and services from our firm, Qualitative Analytics. We also hope that our software will eventually help the Socionomics Foundation to publish academic papers that further validate the Wave Principle and socionomic theory. The EWAVES project, however, will never be "done." There is always room for improvement.

On the practical side, we offer a variety of services for people interested in capitalizing on the real-time opportunities that we identify in the markets. Readers can learn more and explore our open-access publication at ewaves.com.

SF: How does your work relate to social mood?

Elliott Prechter: Social mood is patterned according to the Elliott Wave Principle, and these patterns manifest in financial price data. EWAVES analyzes financial price data through the lens of the Elliott Wave Principle to forecast the future. Its approach is in line with the Socionomic Theory of Finance. It eschews economic "fundamentals" and recognizes that since social mood is both patterned and endogenously regulated, then the best way to forecast it is by looking at the patterns in a good sociometer.

SF: You attended the 2014 Social Mood Conference. Can you tell us about the experience?

Elliott Prechter: Last year was a lot of fun! My favorite presentation was Matt Lampert's talk about the Las Vegas real estate collapse. It still amazes me how most people always apply linear projection in their analysis despite the fact that it always results in devastating overleveraging right at the most inopportune times.

SF: Now you're returning to the conference as a speaker. What excites you the most?

Elliott Prechter: I'm looking forward to speaking in front of a group, which I greatly enjoy—especially if the topic is something I am passionate about. The EWAVES team has been hard at work for a long time, and it's rewarding to finally be able to discuss some of our efforts in person. I am also especially looking forward to Alan Hall's "Deep Time" presentation—the socionomic perspective on the evolution of the universe, the solar system, earth, life forms and human culture. It should yield some new insights.

SF: Thank you, Elliott.

Watch Elliott Prechter and the ten other excellent presentations from the 2015 Social Mood Conference right now from your PC or mobile device via an on-demand broadcast>>

FREE TO SUBSCRIBE, FREE TO SHARE

The *EWAVES Flash* publication is open-access. Feel free to share the link ewaves.com/1510EWF for this issue, or visit ewaves.com and click on the "newsletter" tab to read other issues or to sign up for alerts when new issues are published. To subscribe to Flash Services, use the "services" tab or go directly to ewaves.com/flash-services

CITATIONS

[1]Basic Questions. (n.d.). Retrieved October 22, 2015, from http://www-formal.stanford.edu/jmc/whatisai/node1.html

[2]Dialogues with colorful personalities of early ai. (n.d.). Retrieved October 22, 2015, from http://www.stanford.edu/group/SHR/4-2/text/dialogues.html

[3]Digital computers applied to games'. n.d. AMT's contribution to 'Faster than thought', ed. B.V. Bowden, London 1953. Published by Pitman Publishing. TS with MS corrections. R.S. 1953b
Paper, 10 sh. in envelope

[4](n.d.). Retrieved October 22, 2015, from http://wright.chebucto.net/AI.html

[5]Jayanti, V. (Director). (2003). Game Over: Kasparov and the Machine [Motion picture]. Thinkfilm.

[6]Techniques in Artificial Intelligence (SMA 5504). (n.d.). Retrieved October 22, 2015, from http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-825-techniques-in-artificial-intelligence-sma-5504-fall-2002/

[7]The truth about the Turing Test. (n.d.). Retrieved October 22, 2015, from http://www.bbc.com/future/story/20150724-the-problem-with-the-turing-test

EWAVES Flash is published by Qualitative Analytics, Inc. Mailing address: P.O. Box 3102, Gainesville, Georgia, 30503, U.S.A. http://www.ewaves.com. All contents copyright © 2015 Qualitative Analytics, Inc. The *EWAVES Flash* publication may be freely shared and redistributed for non-commercial purposes provided it is not modified from its original form and all credit is given to Qualitative Analytics, Inc. You may not use this work for commercial purposes without the permission of Qualitative Analytics, Inc. Otherwise, feel free to quote, cite or review if full credit is given. Dissemination of Flash recommendations made by Flash Services is strictly forbidden.

Contact Customer Service: Call 770-536-0309 (internationally) or 800-336-1618 (within the U.S.). Or email info@ewaves.com.

At no time will Qualitative Analytics make specific recommendations for any specific person, and at no time may a reader, caller or viewer be justified in inferring that any such advice is intended. Every investor should perform his or her due diligence. Investing carries risk of losses, and trading futures or options is especially risky because these instruments are highly leveraged, and traders can lose more than their initial margin funds. Regardless of your investment vehicle, you should only risk what you can safely afford to lose and recognize that losses could also result from system-wide liquidity problems, broker failures, trades canceled by the exchanges, etc. Information provided by Qualitative Analytics is expressed in good faith, but it is not guaranteed. The market service that never makes mistakes does not exist. Long-term success trading or investing in the markets demands recognition of the fact that error and uncertainty are part of any effort to assess future probabilities. Please ask your broker or your advisor to explain all risks to you before making any trading and investing decisions.