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Design And Test A System

Now, Set Up The Process

Last time, we covered the basics of what a system is, why you need one, and how to find one. This time, you will learn how to design and test a system, whether it is your own or someone else's.

by Sunny Harris



he steps to building a system are simple. They are: Find the right indicator. Design your setups, and determine when to buy, when to sell if you're right, and when to sell if you're wrong. Test the system. And finally, analyze the

results. That's about it. It sounds easy when I put it that way, doesn't it? Well, it's not really difficult; it's just tedious. But here's why you need to go through it all.

FIND THE RIGHT INDICATOR(S)

Many traders like to put a variety of indicators and/or systems on their charts in the hope that the more they add, the more likely they are to capture profits.

Unfortunately, that is the least likely approach to capturing real-time profits. While indicators on charts *look* great, when you are reading a chart as it is forming, it is difficult to tell what the market might do next. So how do you find out?

Knowing there is money to be made going long and short because of the potential hourly wage (PHW) analysis (as explained in my June 2012 article) in the choppy market presented in Figure 1, we must determine what approach will net us something close to the 40% PHW number calculated.

I like to leave the yellow-dot indicator on my chart while I am conducting research and I am trading to remind myself to examine just how close I am getting to the ideal. The problem becomes one of finding an indicator or pattern that gives us close approximations to the yellow dots. If we find an indicator that gives more signals than the ideal, that's okay. We can always weed out extraneous signals with filters and pare back to the optimal dots configuration.

The first approach I examine is a simple moving average (SMA) strategy.

TRADING SYSTEMS



It's not really difficult to build a system; it's just tedious. But here's why you need to go through it all.

Let's put two SMAs on the chart and see how close their crossovers approximate the dots. Just in case you are not familiar with this approach, two moving averages can be used to generate a signal when one crosses over the other. When the fast moving average crosses downward over the slow moving average, it is considered a sell signal; when the fast moving average crosses upward over the slow moving average, it is considered a buy signal. The default values for the fast and slow averages are generally nine and 18, respectively, so that's where we will start.

Taking a look at the blue and green curvy lines in Figure 2, you can see that for the most part the lines are configured with the green one on top when you should be long and the blue one on top when you should be short. It does a good job but there are those choppy times, like around August–September 2011, when the averages cross and aren't in the right position. That choppy period is referred to as a “whipsaw.”

For a moving average system to work, you need a tradable that spends a lot of time trending. You could use a filter that will eliminate the whipsaw by disallowing trades during that time, or by having the trades switch to a channel method.

The first attempt at finding a better indicator should be to try different settings for the indicator we already have. The inputs for the moving averages in Figure 2 are nine and 18. These numbers are the lengths of the respective averages. If

we change these numbers to something tighter, you will see a lot of whipsaw periods. Because the moving averages are tight to the data, whenever the data whips back and forth, so do the averages. This might be okay if we were using a clever filter, but for this exercise we are not. So let's look at exponential moving averages (EMAs) instead of SMAs.

@ES Daily (CME) E-mini S&P 500 Continuous Contract (Jul 12)

@ES Daily CME L=1403.25 3.25 0.23% B=1403.25 A=1403.50 O=1400.00 Hi=1405.50 Lo=1398.75 V=55,145



FIGURE 1: A CHOPPY MARKET. The yellow dots represent ideal entries and exits. The challenge is to find an indicator, pattern or setup that results in close approximations to the yellow dots.

@ES Daily (CME) E-mini S&P 500 Continuous Contract (Jul 12)

@ES Daily CME L=1403.25 3.25 0.23% B=1403.25 A=1403.50 O=1400.00 Hi=1405.50 Lo=1398.75 V=55,105



FIGURE 2: DUAL MOVING AVERAGES. Here, the nine- and 18-period moving averages have been applied. Note that during trading periods, the moving average crossover appears to perform well. During choppy times, such as the period between August and September 2011, the averages cross back and forth several times and do not correspond with the yellow dots in Figure 1.

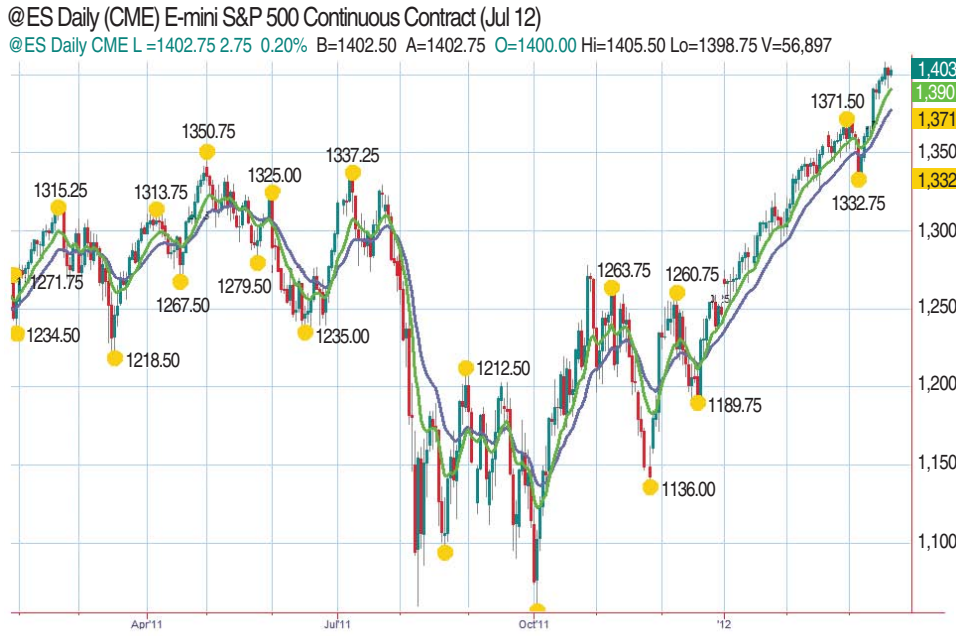


FIGURE 3: EXPONENTIAL MOVING AVERAGES (9, 18). Even though these moving averages have the same settings as the moving averages in Figure 2, several of the whipsaw areas are now gone. These averages come much closer to the ideal entry and exit signals.

The EMAs in Figure 3 have the same initial settings as the simple moving averages in Figure 2. Note how many of the whipsaw areas are now gone. This average better fits our purposes because it reduces several of the whipsaws. The next thing would be to try different input values until you find a set of averages that fits the data well but eliminates much of the whipsaw. That's what led me to develop my dynamic moving average (DMA).

I used nine and 11 as inputs for the DMA. Years ago, it occurred to me that markets are always changing, and while nine and 11 might be the right combination of inputs for the indicator under current conditions, they might not be the right ones in a few weeks or months with the market moving upward, or in sideways congestion. One way to approximate this ever-changing scenario would be to reoptimize your strategy every week or even every day. With that effort, you would be chasing last week's market character with each optimization.

Rather than reoptimizing, it occurred to me that I could determine how fast the market was moving. I call this "speed." If the market averages a one-point range this week, then the speed is one; if the market averages a five-point range this week, then the speed is five, and so on. When the market is moving fast we want a set of averages that are close together and will turn quickly when the market turns. Inputs like the nine and 11 would be ideal for fast-moving markets. Yet when the market gets into congested, sideways periods, you want the averages to get out of the way and not cross over each other. In a sideways market you want moving average input values like 10 and 30. That way, the averages don't come close to each other. Then, as the market changes character and picks

up speed, you want the averages to start coming closer together, preparing for a trend or a trend reversal.

The auto adaptation to change in speed is what I mean by "dynamic." The DMA curves around and holds onto positions, avoiding the whipsaw, until the move is done.

How do we create a strategy out of the moving averages we have? We could use either the simple averages or the exponential. The exponential has more potential in the long run, so we will go ahead and work with that one.

SETUPS

As trader Joe Krutsinger remarked, there are only three things you need to know to make a system: when to buy, when to sell if you're right, and when to sell if you're wrong. Of course, there's

more than that when you are trading entities that allow you to go short. The "buy" becomes a "sell short" and the two sells become "buy to covers." Basically, we can change the saying to: when to enter, when to exit if you are right, and when to exit if you are wrong.



When to enter

With moving averages, you want to enter long when the fast moving average crosses above the slow moving average. You want to enter short — reversing our position — when the fast moving average crosses below the slow moving average.

To illustrate, I am going to stick to the simplest definition of this strategy. Note this strategy is a reversal system, so if you are long and you get a signal to go short, you trade double the number of contracts that you were holding to reverse the long position and go short. On subsequent trades, when you get a signal to go long again, you will trade the same number of contracts and it will reverse the previous position and you will again be long.

This goes on until such time that you want to close out all positions. Then you trade half the number of contracts — or the same number as your original position — so you close out the position without opening a reversal position. This can be tricky; it is easy to end up in the wrong number of contracts.

When to exit if you are right

In a reversal system, you are continually going long and short, reversing the previous position based on the crossing of the moving averages. Let's say, however, that you want a system

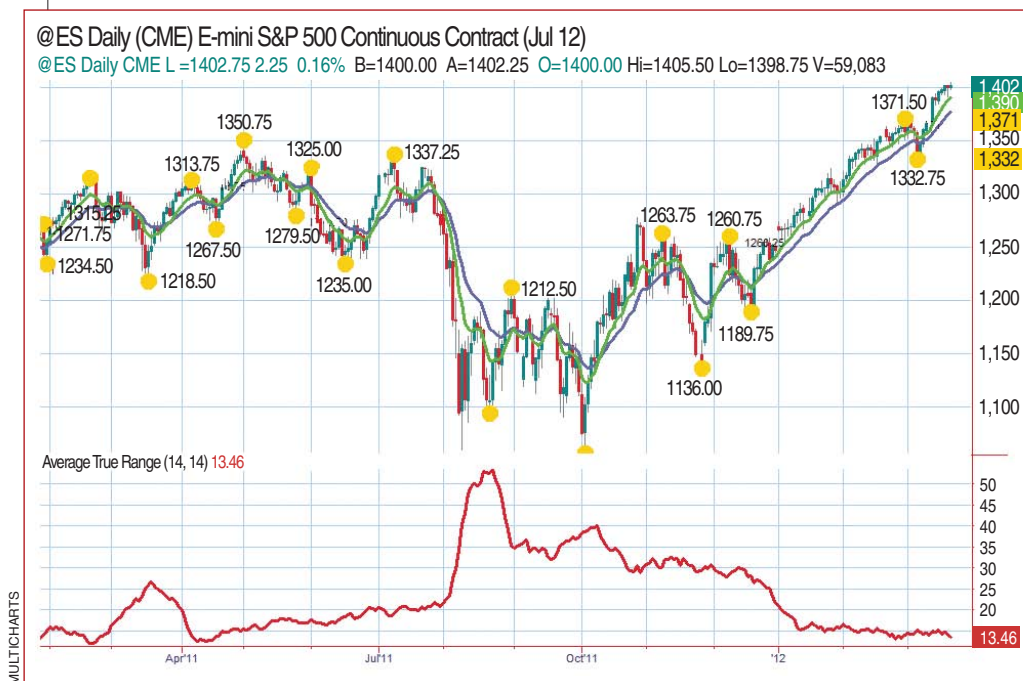


FIGURE 4: AVERAGE TRUE RANGE (ATR). The ATR is displayed in the subchart. Note that it is around 13.46, which indicates there is not much interest, even though price is rallying. Perhaps this is a good time to take some profits.

that takes profits instead of just reversing. In this situation, you would want to take profits at one of several places. Perhaps you want to test the concept of setting a dollar profit target for your “right” exit. Or maybe you want to let the market “tell” you how much profit to take, so you set your target at one or two average true ranges (ATRs) from your entry. Or you could exit at one or two standard deviations from your entry. Yet another method might be to use an oscillator like the relative strength index (RSI) or stochastics as an exit when they are in overbought or oversold territory. These are all good experiments to run.

In Figure 4, I’ve put an ATR on the chart. It is the red line in the subgraph at the bottom. We can see that the average ATR is somewhere around 13.46 points. This low value indicates there is not much interest in the upward price move. This suggests it may be time to take profits.

When to exit if you are wrong

When trading a system that is designed and tested and hypothetically profitable, it will have exits and entries as part of the design. If, however, you are trading by the seat of your

pants, you will want to have this “wrong” exit reminder next to your computer. Always be prepared to get out of a bad trade.

With that said, let’s look at some possible methods for exiting a bad trade.

You could set a hard dollar amount. This might be your pain threshold. Perhaps you are not comfortable losing more than \$100, or \$500, or \$1,000, at which amount you would set your exit stop. Likewise, you might want the market to tell you where to place your exit stops, and you could do this by setting your stop at one or two ATRs from your entry. Or again, you could use the standard deviation the same way.

Generally, you wouldn’t want your profit target and

your stop-loss to be the same size. It wouldn’t make sense to risk losing as much money as you wanted to gain. That would be a 1:1 setup and you would never get ahead, unless the market was always unidirectional. Whenever you design a strategy, you need these three components: entry, right exit, wrong exit.

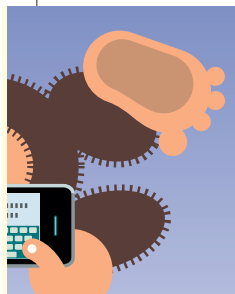
OTHER PEOPLE’S SYSTEMS

Maybe you have a dearth of good ideas, or maybe you believe a smart man learns from his mistakes, while a wise man learns from the mistakes of others. Whatever the reason, it never hurts to examine what other people have done.

When you acquire a strategy from someone else, whether it is a black box you purchase or a few lines of ideas from a book you picked up in the library, always test the strategy. Don’t *assume* it will work. You must know the results before you put your hard-earned money into it. If you don’t test it, you will lose money with it. As soon as it gets into a drawdown period — and *all* systems do — you will quit trading it. You will stop at the worst point when you have a big loss staring at you. This situation is the cause for a great many losses.

I read trading books, old and new. Every now and then I will revisit ideas that have been hidden for years. I don’t believe everything I read. With every new idea, I get out pen and paper and write down the three rules: entry, right exit, wrong exit. And then I go to my software and I program the ideas. I test everything. If you decide to purchase a black box indicator or strategy, you wouldn’t be able to test it since you wouldn’t know the algorithm behind the system. It would bode well for you to ask for a trial first before committing to the black box.

One of the most glaring false advertising gimmicks is the



Maybe you believe a smart man learns from his mistakes. Whatever the reason, it never hurts to examine what other people have done.

90% correct system. Professionals typically trade systems that are 40% to 50% correct. That's about as good as it gets. The systems with the high accuracy either have few trades, or they have small wins, or they are so tightly curve-fitted to the data they don't work in the future.

You also have to be careful about which seminars to attend. Some are worth the thousands of dollars you pay for them, while some are not. Nevertheless, if you get one good idea out of a seminar, it is worth the price you paid. On occasion, the good idea you'll get is what not to do. That is also worth it. Before you sign up for an expensive seminar, do some research on the speaker(s) and the hosts.



TESTING THE SYSTEM

Whichever way you go, you will want to apply a series of tests to the program before putting real money into trading it. Never jump in and trade a system that you haven't tested. The testing process should be laborious, and to keep everything straight, you will need to keep a detailed logbook (or a

spreadsheet on your computer). Whichever method you use, keep a detailed log of your efforts or you will end up with no meaningful results.

An idea logbook contains information such as the symbol, chart time frame, bars/days back, profit/loss, average trade, number of trades, percent profitable, and ratio. Use it as a jumping-off point and add your own data, so when you look back at your efforts, you will be able to draw meaningful conclusions.

STEPS FOR CONDUCTING SYSTEM TESTS

There are four essential steps to any project, whether it is creating a new business or designing a trading system. They are observation; research; programming and quality assurance; and marketing and sales. These same steps can be translated into terminology specific to trading and system development, so they translate as:

- 1 **Observe** price action and ask, "What is true?"
- 2 **Research** and develop a systematic approach
- 3 **Programming and QA:** Test the system before trading it and prove the system can profit
- 4 **Marketing and sales:** Follow the system.

Recently, I heard all motivational speakers summarized as "Idea, plan, stick, stick, stick." The same summarizer asked how you get your first idea. That is what our step 1 is for. Observation generates the ideas. Getting the right answers is only about asking the right questions.

Look at the markets first. Observe the ones you are interested in. See what they are doing. What is that market doing? What time frame(s) should you be testing? What is the rhythm of this market? Is there a natural cycle in any particular time frame? What time frame and what symbol(s) are there significant-enough moves to produce a profit? What happened right before

the big move? What led up to the big move?

After you answer these questions you can move on to step 2. You can't test every symbol, in every time frame, in every market. The job is daunting enough without making it impossible.

Steps 2 and 3 lead you down the path of research. Here's where you look for systems that make sense in your markets of interest. This is when you research literature and attend seminars and lectures. After this preliminary work, you will begin the scientific part of the research: coding systems, buying systems, and testing them with your software. Here's where the logbook comes in.

Step 3 also involves the use of a statistic I call the cardinal profitability construct (CPC) index. It is my cardinal rule. Without this I could not tell how one system would compare to another. To figure a system's CPC index, you read three performance statistics from the system performance report: profit factor, percent profitable, and ratio of the average win to average loss. You multiply these three numbers together and come up with a single one that you use to evaluate all systems. If this CPC index is less than 1.2, you don't trade the system.

In testing systems recently, we found several systems that looked good at first glance. The net profit was large, the equity curve looked good, and the average trade was even pretty large. But the CPC index came out to numbers fewer than 1.0. In fact, many of them were in the 0.2–0.5 range. The problem was in the ratio of the average win to average loss. In each failing case, the ratio was small. This means the wins might have been \$1,000, but the losses were also approaching \$1,000. To have a good system, you want this ratio to approach 2.0, or even exceed it. Analyst John Bollinger said that good systems need the ratio and the profit factor to be 2.0 or greater. I don't think it needs to be that strict, which is why I came up with my CPC index. It allows one of the components to be smaller and the net result to be overall profitable.

Step 4 is "Follow the system." If you can't follow the system, it means that either you have a psychological problem or you haven't sufficiently tested your system.

ANALYZING THE RESULTS

Most trading software that offers backtesting features will produce a strategy report of any system you are testing. The results will be hypothetical, so don't mistake these results with reality. Inevitably, you will do worse than the report implies when you trade the system with real money. You will experience more slippage and more losing trades than you would expect.

I looked at the strategy performance reports (SPRs) of four popular software programs — Genesis Navigator, TradeStation, MultiCharts, and MetaStock. SPRs display statistics such as net profit, profit factor, percentage profitable, and maximum drawdown. To compare any trading system to another, I use the CPC index. The three numbers for input to the CPC equation — that is, profit factor, percent profitable, and ratio of the average win to average loss — are found in various locations on the different SPRs. In MultiCharts you have to look around; it's not on the first page. In the Genesis Navigator report, they

TradeStation Performance Summary Collapse ▲			
	All Trades	Long Trades	Short Trades
Total Net Profit	\$18,537.50	\$11,537.50	\$7,000.00
Gross Profit	\$92,100.00	\$46,325.00	\$45,775.00
Gross Loss	(\$73,562.50)	(\$34,787.50)	(\$38,775.00)
Profit Factor	1.25	1.33	1.18
Roll Over Credit	\$0.00	\$0.00	\$0.00
Open Position P/L	\$300.00	\$300.00	\$0.00
Select Total Net Profit	\$16,900.00	\$14,775.00	\$2,125.00
Select Gross Profit	\$85,350.00	\$46,325.00	\$39,025.00
Select Gross Loss	(\$68,450.00)	(\$31,550.00)	(\$36,900.00)
Select Profit Factor	1.25	1.47	1.06
Adjusted Total Net Profit	\$4,239.99	\$1,714.14	(\$3,410.57)
Adjusted Gross Profit	\$83,196.36	\$40,189.10	\$39,301.44
Adjusted Gross Loss	(\$78,956.36)	(\$38,474.97)	(\$42,712.00)
Adjusted Profit Factor	1.05	1.04	0.92
Total Number of Trades	294	147	147
Percent Profitable	36.39%	38.78%	34.01%
Winning Trades	107	57	50
Losing Trades	186	89	97
Even Trades	1	1	0
Avg. Trade Net Profit	\$63.05	\$78.49	\$47.62
Avg. Winning Trade	\$860.75	\$812.72	\$915.50
Avg. Losing Trade	(\$395.50)	(\$390.87)	(\$399.74)
Ratio Avg. Win:Avg. Loss	2.18	2.08	2.29
Largest Winning Trade	\$3,437.50	\$2,937.50	\$3,437.50
Largest Losing Trade	(\$1,875.00)	(\$1,687.50)	(\$1,875.00)
Largest Winner as % of Gross Profit	3.73%	6.34%	7.51%
Largest Loser as % of Gross Loss	2.55%	4.85%	4.84%
Net Profit as % of Largest Loss	988.67%	683.70%	373.33%
Select Net Profit as % of Largest Loss	901.33%	875.56%	113.33%
Adjusted Net Profit as % of Largest Loss	226.13%	101.58%	(181.90%)

FIGURE 5: TRADESTATION STRATEGY PERFORMANCE REPORT. The profit factor, percent profitable, and ratio of the average win to average loss are all found in one page.

Enhanced System Tester - Result Details View			
Summary			
Equis - CCI +100/-100 Crossover		E-MINI S&P 500 Stock Index CME Jun 12 (us@ES12M)	
Simulation Date 4/1/2012 10:15:54 AM		250 Daily Bars 3/25/2011 Through 3/30/2012 (371 Days)	
Performance		Performance Indices	
Profit	\$309.60	Buy & Hold Index	-97.24 %
Performance	3.10 %	Profit/Loss Index	100.00 %
Annualized Performance	3.05 %	Reward/Risk Index	100.00 %
Buy & Hold Profit	\$11225.00	Accounting	
Buy & Hold Performance	112.25 %	Initial Equity	\$10000.00
Buy & Hold Annualized Performance	110.43 %	Trade Profit	\$0.00
Trade Summary		Trade Loss	\$0.00
Total Trades	0	Commissions	\$0.00
Trade Efficiency	0.00 %	Interest Credited	\$309.60
Average Profit/Average Loss	N/A	Interest Charged	\$0.00
Profitable Trades		Final Equity	\$10309.60
Total	0	Open Positions	\$0.00
Long	0	Account Variation	
Short	0	Highest Account Balance	\$10309.60
Average Profit	\$0.00	Lowest Account Balance	\$10000.00
Highest Profit	\$0.00	Highest Portfolio Value	\$0.00
Lowest Profit	\$0.00	Highest Open Drawdown	\$0.00
Most Consecutive	0	Highest Closed Drawdown	\$0.00

FIGURE 6: METASTOCK'S STRATEGY PERFORMANCE REPORT

provide the CPC index itself on the first page! And in TradeStation the three stats are on page 1 (Figure 5).

Obviously, if the net profit is less than zero, you have a losing system. Do not commit real money, no matter how cool it looks on a chart. In addition, if the drawdown is larger than your account value, do not trade the system. Beyond that, many of the stats are superfluous, and many are interesting but not required. If you run the CPC index and find it is a tradable system, then you can study the remaining statistics.

While the first three reports are similar, the system testing feature in MetaStock bears further investigation. Of the three, this is the only one that will allow you to test the same strategy over a list of different symbols (Figure 6).



TRADING THE SYSTEM

You should spend about 20% of your preliminary efforts in system design, and another 20% in system testing. After you have labored long and hard in the testing phase, and you have found a system or systems with a CPC index greater than 1.2, only then should you begin trading. Trading should be the easy part if you've done your homework.

After you've found a successful system, trading should be performed by pressing the right buttons: buy, sell, enter, exit. If you find you are not following your system, go back to the drawing board and test some more. If your system quits working, it is either because the market has changed character and you need to do some more designing, or your system was too tightly curve-fit to the market you were testing. In either case, spend some more time on the drawing board.

Each trading platform is different. Some require that you trade through their own brokerage firm, while others include several brokerages in their platform. The trade windows may be different.

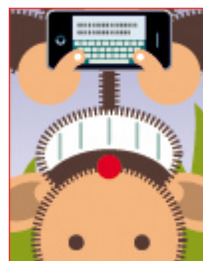


FIGURE 7: MULTICHARTS TRADE PANEL. It is easy to place trades and set your stops and limits.

In Figure 7 you see the trade panel for MultiCharts. It is easy to place trades and set your stops and limits. These days, more and more trading platforms are offering point & click chart trading, where you can place your trades right from the chart. The trade bar in Figure 8 shows how chart trading works. See the trade console attached to the chart? This allows you to buy and sell exactly what you are looking at.



FIGURE 8: GENESIS NAVIGATOR TRADE BAR. You can have a trade console attached to the chart you are trading. You can buy or sell what you are looking at.



CONCLUSION

The concepts covered here are elementary, but it gives you an idea of what steps you should take to understand the process of setting up a systematic method for trading. Once you have these basics down, you will be better able to control your losses.

Sunny Harris is an author, trader, computer programmer, and mathematician, who has been trading since 1981. The first printing of her first book, Trading 101, sold out in two weeks and continues to be a financial best-seller; her second book, Trading 102, also achieved record sales. In early 2000, Harris released Electronic Day Trading 101, followed by Getting Started In Trading in 2001. Her latest book is TradeStation Made Easy. She may be contacted at MoneyMentor.com.

SUGGESTED READING

Harris, Sunny [2012]. "First, You Design The System," *Technical Analysis of STOCKS & COMMODITIES*, Volume 30: June.

‡TradeStation ‡Genesis Navigator ‡MultiCharts ‡MetaStock

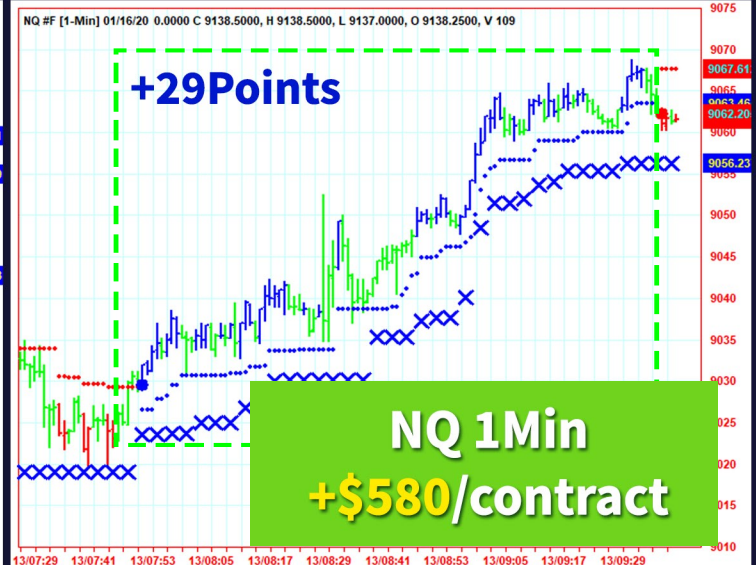
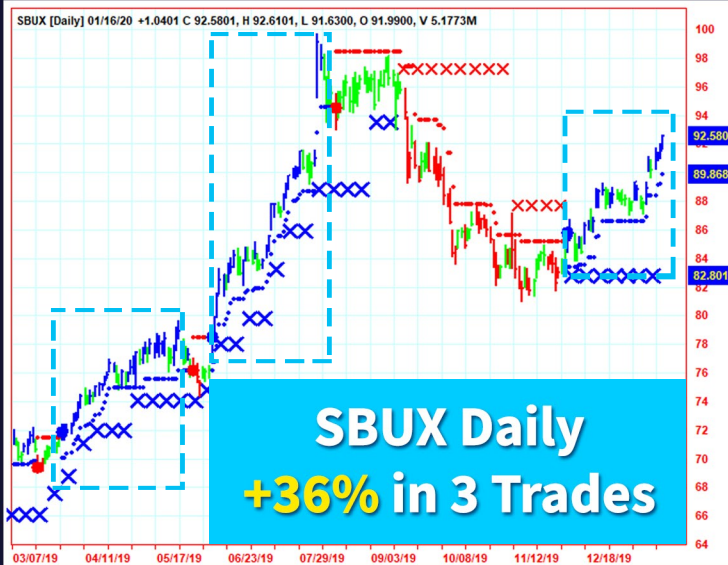
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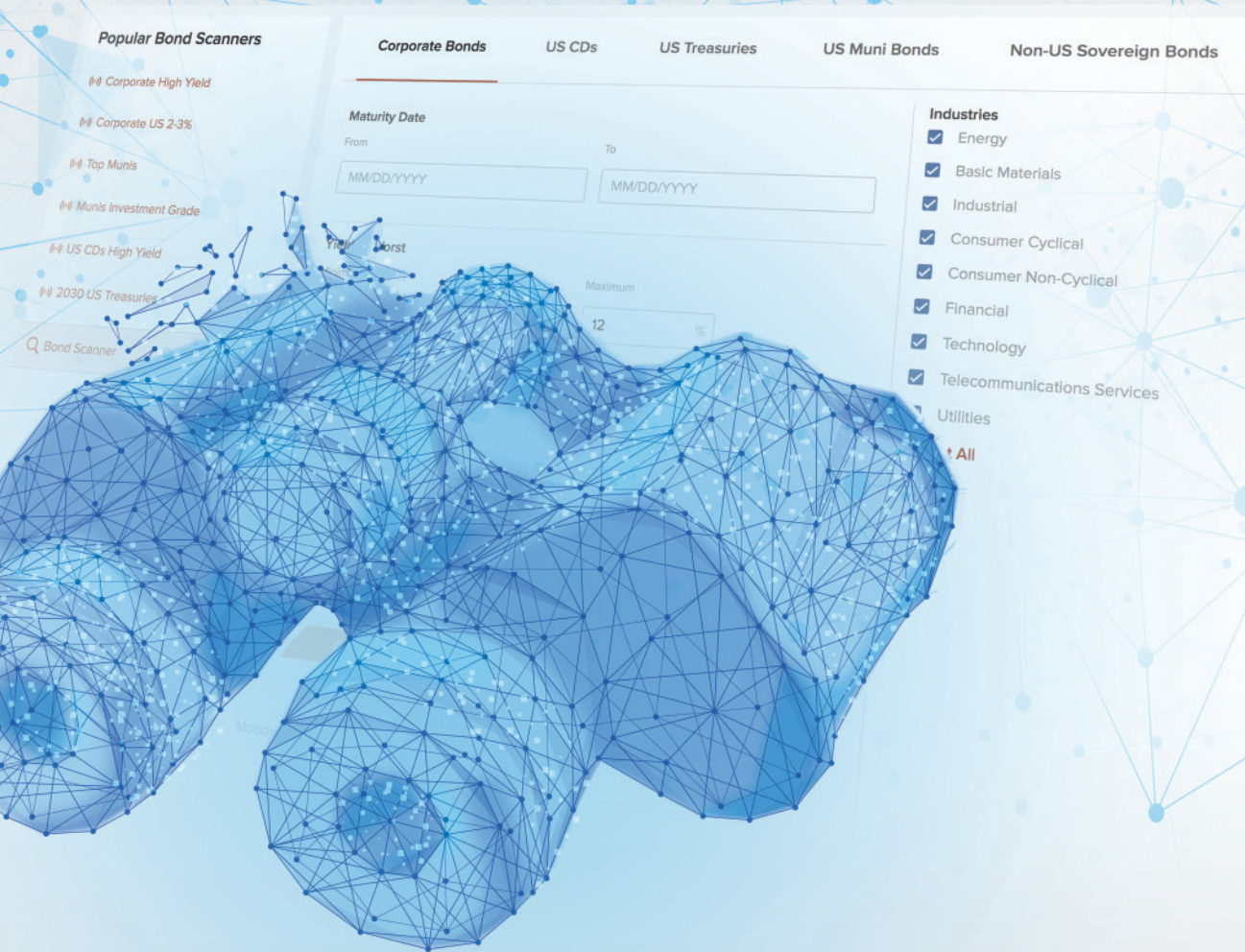


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