

Developing a more innovative ‘Forex’ trading application to shape new and improved trading experiences

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Abstract

The World is now almost completely online, and with it anything can be achieved using the internet. There is nothing you cannot buy and have delivered to your front door, nor information that cannot be found. It has truly revolutionised retail, banking and entertainment. In banking, or more specifically, in trading stocks and currencies, it is no longer the realm of the city workers in pin-striped suits. The non-trader can now easily go online and trade in these commodities. Nonetheless, most people find the idea of ‘Stocks and Shares’ intimidating, but only through a lack of knowledge or lack of skills to research the subject. In this paper, we perform a systematic literature review to discuss the foreign exchange market (aka Forex) and to identify all publicly available online trading platforms that exist to aid the trader. We analyse these platforms to then develop a more usable tool, called Moving Averages Trading Platform (MATI). This tool uses simple moving averages that calculate the financial data and display it on a user interface (UI). An initial study is undertaken to test the usability and appeal (i.e. trustworthiness) of the tool. Overall, the results show that almost half of those tested would both use and trust the software developed. However, it is also clear that the design of the UI could be further improved (i.e. more work on the visualisation of the data to lead to more return and repeat usage). Despite the panic that Covid-19 has spread across the globe, the Forex Market is still strong. With some novel technological tools, the authors of this paper feel that

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there are opportunities for the everyday person to benefit from this.

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1. Introduction

Foreign exchange is a fast-paced, finance driven market where trillions of dollars are traded per day and large amounts of money can be made or lost. Just like getting your holiday money; foreign exchange simply works by buying one currency with another currency, but on a much larger, global scale. Indeed, similar to getting your holiday money, traders will wait to get the best deal. As prices are changing every second of every day, traders use a variety of mathematical tools, and a sprinkling of knowledge to keep up with the fluctuations of these currencies. In doing so, they hope that they will spot the exact opportunity to make the most profit. These actions play a vital role in the functioning of the economy of a country however the question arises: could the everyday person on the street be able to capitalise on this too? With a basic understanding of computers and how to install software would they want to engage in this fast paced world of buying and selling? This paper will investigate the foreign exchange market (aka Forex) and some of the current ways to trade, particularly different types of architecture already in mainstream existence. The present initial study will leverage through technology a synergy between humans, and Forex and in doing so aims to provide to the general public a new type of trading platform and a new way to engage with Forex. The paper will describe the design and implementation of an engaging prototype, MATI, and the evaluation results.

2. Human-Engaged Computing (HEC) and the Stock Exchange

Engagement is a very important aspect of any online products, systems, and/or services. As Doherty and Doherty (2019, p.29) state ‘Engaging experiences are built on usable interaction’. Moreover, Human-Engaged Computing (HEC) is about establishing synergised interactions between engaged humans and engaging systems that will enable people to realise their full potential and create a better world (Ren et al., 2019). The aim of this research is to design for an engaging and trustworthy online trading experience where the user not only becomes involved and drawn into experience, but also becomes interested in continual interaction. To achieve this it is important to understand the stock exchange, the following sections aim to give a little more insight into the Forex experience and the techniques that currently exist for use.

2.1. *What is Forex?*

The London Stock Exchange, New York Stock Exchange, Dow Jones et al all deal with companies that have ‘floated’. To ‘float’ a company means that it changes from privately owned to being publicly owned. Companies float on a stock market as a way of raising capital. This floatation is in the form of shares that people can purchase. Some people buy these to become shareholders in the company; others, traders, may use these shares to make a financial profit at a later stage. Commodities are assets like gold and oil that, like a company, can be traded on; prices move based on supply and demand for each commodity, along with how much is available. The Forex markets work on the same principle except people trade in world currencies. Forex is a global market of institutions trading the predominant currencies of the world. The Market is open from Monday morning (starting with Asian markets) and closes on Friday evening (closing with the American markets). Trades occur 24/7 throughout this time. Traders range from large, multinational companies to individual investors. The average daily turnover of trades in the market is averaged at \$5.1 trillion per day (for International Settlements, 2016). In much the same way

that positive/negative information about a company will alter the price of their share value, Forex prices are affected by factors such as a nation's economy, politics, weather or unforeseen events such as COVID-19.

2.1.1. How does it work?

Currencies are traded in pairs, the value given with the pair is the cost to buy the base currency. For example, GBP/USD 1.3505 (Pound Sterling/US Dollar) indicates £1 would buy \$1.3505. If the price is expected to rise, this would be known as “going long”. To “go short” would be to sell the Pound with the option to buy it back at a lower price. The rise and fall of currencies in all markets is undetermined and completely random. However, experienced traders are able to spot repeatable price action patterns and are able to place a trade with some degree of certainty that the trade will end profitably. Not all traders are the same, generally, there are four types:

- Position Trader: Trades for long-term investments of months or even years
- Swing Trader: Trades for a week-long investment
- Day Trader: Will make 2-3 trades per day
- Scalper: Scalpers are fast-acting, get-in-get-out traders, making multiple trades per day.

2.2. Moving Averages

Most, if not all, methods used in Forex are time series analysis. These are written to predict the future prices of currency pairings. One of the earliest was SMA, a simple averaging technique; this evolved to Weighted Moving Average (WMA). Exponential Moving Average (EMA) is a type of WMA that was merged to create Weighted Exponential Moving Average (WEMA)(Hansun, 2013, 2014). Furthermore, Double Exponential Smoothing became B-DES and was later merged by Hansun (2016) to become B-WEMA.

In simple terms, moving averages are just a mathematical calculation of previous values of the currency pair and are used to make a prediction on the

next value. An example would be a 5-day moving average as shown in Table 1. 15th Jan shall be today (the day we wish to predict), a 5-day count back will calculate data from 8th to 14th (the weekend is not used as the markets are closed). Table 2 gives the same example for the 17th Jan.

<u>Mon</u>	<u>Tue</u>	<u>Wed</u>	<u>Thu</u>	<u>Fri</u>	<u>Sat</u>	<u>Sun</u>
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Table 1: 5-day moving average for 15th Jan 2020.

<u>Mon</u>	<u>Tue</u>	<u>Wed</u>	<u>Thu</u>	<u>Fri</u>	<u>Sat</u>	<u>Sun</u>
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Table 2: 5-day moving average for 16th Jan 2020.

2.3. Error Detection Techniques

Along with the various Moving Average methods that can be utilised, there is also a means of comparing the predictions. Hansun (2017) details using both Mean Square Error (MSE) and Mean Absolute Percentage Error (MAPE) as a means of error detection (ED) to test that WEMA and B-WEMA produce the same accuracy. Mean Absolute Deviation (MAD) and Mean Root Square Error (MRSE) (or RMSE) are other examples of error detection.

In more detail, error detection is a way for the user to gauge the accuracy of moving average data versus the actual data. Mathematically, the goal for error detection equations are to be as close to zero as possible. EUR/GBP is

presented to 5 decimal places, therefore an error detection of 0.00000 is the desired result for every outcome.

2.3.1. Mean Absolute Deviation

MAD is derived from the positive difference between the data point and the MA (based on whichever is used); the results are then totalled and divided by the number of calculations performed. The performance indicator, when using MAD, is how close the number is to zero (Chunhua et al., 2011).

$$MAD = \frac{\sum_{C,S=1}^n |C_n - S_n|}{n}$$

Where C is the closing price and S is the SMA value; n is the number of results calculated. MAD can also be referred to as Mean Absolute Error (MAE).

3. Machine learning and Forex

One type of algorithm used in Forex is SVM which uses Statistical Learning Theory. This is a supervised learning model of machine learning that contains a small sample to research learning rules but also helps to reduce, or eliminate, overfitting (Hui and Wu, 2012). In their research (Hui and Wu, 2012), tested SVM alongside SMA and resistance/support, Kestner & trading range break filters. This research was stock exchange based and an interesting point in the paper was the volume of trades (28.6% in May 2011) that used some sort of computer-based program to complete a transaction (Hui and Wu, 2012). The paper highlights the need for “*software and auxiliary function to be used whilst trading*” (Hui and Wu, 2012). A buy and sell (or sell and buy) action is generally referred to as a trade. Indeed “*34% of the trading volume in the second quarter of 2002 comprises some form of computer-aided trading*” (Ellis and Parbery, 2005).

In fact, SMA can be used to support other classifications. Incorporating a neural network to map news items where positive sentiment had a value of 1 and negative sentiment had a value of -2 (Lauren and Harlili, 2014) were

then able to use SMA 33 to prove that positive news items had a positive growth on the JKSE (Jakarta Stock Exchange). Much like Lauren and Harlili (2014) converting news into a positive or negative number, Baasher and Fakhr (2011) used a binary method, coupled with SVM, RBF & MLP machine learning techniques, to predict the direction of the high rate. (Each currency pairing has four daily rates: Open, Closed, High & Low). The aim was not to predict the price, it was to predict the correct direction of the pairing.

One type of Machine Learning is Deep Learning, and within this field are Neural Networks. These too can be used as a tool to predict Forex. For example, Sespajayadi et al. (2015) combine genetic algorithms with neural networks, with Root Mean Square Error (RMSE) for error detection, to predict the EUR/USD. Whilst many chose to predict just the close value, Sespajayadi et al. (2015) decided upon predicting all four movements, open, close, high & low. All gave an RMSE of great than 0.001.

4. What software is already available to use?

There are three platforms that Forex trading is readily available on:

4.1. Web-based

There is a range of software available to trade Forex. The aptly named Forex.com is a web-based program. Along with other types of indicators, it provides a larger range of moving averages such as Arnaud Legoux, Least Squares, Hull, Exponential, Weighted, Smoothed, Simple & Channel. The layout of the user interface (UI) is simple but effective, there is little clutter to distract the user. However, there are a range of indicators to select from and as Figure 1 shows, with just six indicators selected it can be hard to decipher which indicator is which. The six indicators (Moving Average Channel (MAC), two versions of Double Exponential Moving Average (DEMA), a Bollinger Band (a form of double moving average), a Moving Average and an Exponential Moving Average) makes it look unorganised. The Bollinger Band is the upper and lower limits (called envelopes) of the light blue shaded area.

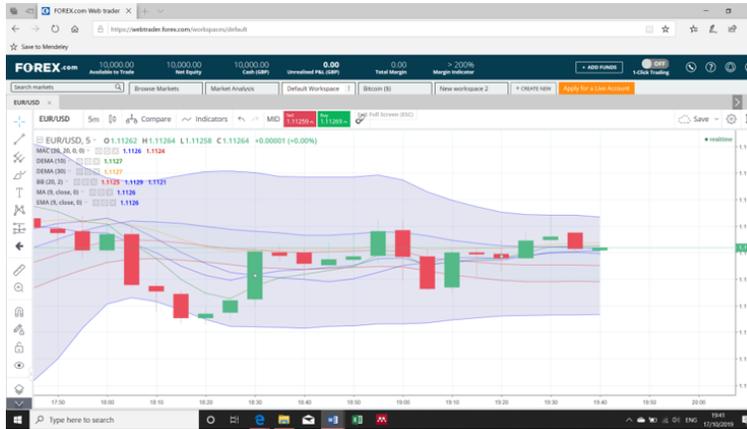


Figure 1: Forex.com.

Another online trading platform is FXTM. This is available from forex-time.com. Registration is easy and includes a two-factor authentication on registration, but it seems that this is not needed when logging onto an active account. The website prompts for a lot of personal information that is not required in order to set up a demo account. As well as name, date of birth and address, it also requested an identity document and proof of address. The website displays low ethical qualities and raises questions as to why all the data is required. FXCM.com showing in Figure 2 displays the same moving average indicators as Forex.com and as such demonstrates how easy it can be to become lost in the data. There are, of course, plenty of websites that provide Forex trading: CityIndex.co.uk, Intertrader.com, IG.com, Fondex.co.uk, FxPro.uk, ICMarkets.com and Pepperstone.com. These either, provide the same information and user interface styles as those already discussed or require personal information to open a demo account.

4.2. Smartphone applications

Forex.com, despite giving a PC-based platform for Forex trading, gives some foreign exchange rates but focuses more on commodities. Furthermore, there is nothing in it's smart application that allows the user to select any indicators. FXCM too has an application for smartphones. The application opens to a



Figure 2: FXCM.com.

blank screen asking the user to accept the terms of agreement. Forex Signals, Figure 3, is not so much a trading application more of an application that informs you of some trading signals. There is no ability to be able to look at the various markets, nor to select a currency pairing.

Trading 212 is a good application for traders, it provides the standard information in the user interface and a range of indicators that the user can overlay onto the currency pairing as we see in Figure 4. The downside of this application, like all web-based platforms, is the inability to understand how to proceed. It is unlikely a non-trader can read these and instinctively know when it is a good time to trade or not.

MetaTrader is the program being used to download the live data within the paper, it has the same functionality as Trading 212; good – but not suitable for the non-trader. Again there are plenty more to choose from, some very poor and some really good for the experienced trader. As far as the authors can determine, there is very little available for the non-trader.

4.3. Downloaded software

MetaTrader 4 has previously been mentioned as software that can be downloaded to run on a user's desktop or laptop. MetaTrader 4 updated to MT5. MT4 and MT5 use a database called MetaEditor. MetaEditor gives the user

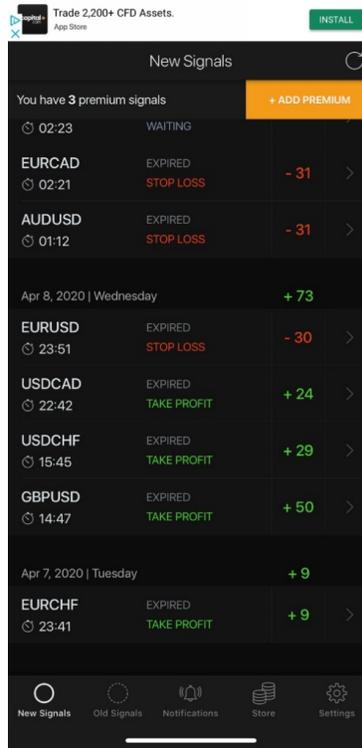


Figure 3: Forex Signals.

the ability to call historic data from its database. MetaEditor uses MetaQuotes Language (MQL) 4 & 5 respectively as its language. MQL is syntactically based on the C language.

cTrader, similar to all the reviews here, gives the same types of information and allows the user to place trades in a demo or a live account. cTrader has a built-in editor; this programming language is cAlgo and allows customised indicators using C#. Social trading is a relatively new idea that gives novices and/or investors a way to earn from Forex trading. It works in two ways:

1. Copy trading – the novice copies the trading patterns from an expert trader. It can be seen as a way to reduce the learning curve from novice to expert. This is also known as Open Book.
2. Mirror trading – when the expert trader executes a trade on their account



Figure 4: Trading 212.

it automatically executes a trade on the investors account.

A third aspect of social trading is where traders share their knowledge with other traders. Rather than trading against each other, more so, they are pooling resources and trading against the market. There are a range of platforms that give this experience: eToro, ZuluTrade, Ayondo, Tradeo and Darwinex are to name a view.

5. MAT1: Why is this application different?

The application, which has been called MATI, moves away from the clutter of the previous screens and provides a numbers-based snapshot of all the current indicators. The other significant difference is that MATI takes all the previous data and then informs the user “If I traded with this data in the last x minutes,

I would have been x% accurate.” These two differences, which have not been seen in any other FOREX-based platform eliminate the need to understand and digest a multitude of indicators and trade just on the applications’ percentage of correctness over the last x minutes. The design of MATI falls into three broad categories:

1. Write code to capture data from MetaTrader 5 and export to SQL
2. Tabulate the data within SQL, remove all non-essential data and create Moving Average and Error Detection values
3. Create a GUI in Java and import the MA & ED values

Firstly, this required the production of code to capture data from an online data source: MetaTrader5 and stores this in a database to be called upon when needed. Secondly, it involved the production of code to display a GUI that details the predicted direction of the currency pair based on moving averages, along with a percentage of accuracy for the last prediction. Finally, the production of code was necessary to feed the algorithms with the data needed to be displayed in the GUI.

5.1. MetaTrader5

MT5 is a software application provided by MetaQuotes Ltd that allows users to trade in Forex currencies. It provides the user with a range of indicators, oscillators, moving averages and many more mathematical equations that aide the trader. MT5 also contains a sub-program called Meta Editor 5. MT5 operates in the MetaQuotes Language (MQL); a C-based language. MT5 allows the user to customise the MT5 platform for their own trading needs. Using an add-on application called MT5 Data Downloader Tool (MT5DDT), Figure 5, users have the ability to download various currency pairings with multiple timeframes.

5.2. SQL

Short for Structured Query Language, SQL is used for databases. A database is essentially a record of records. A company’s HR department will have database

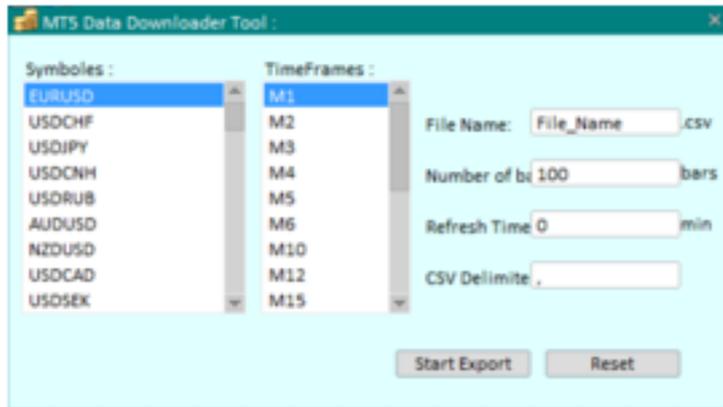


Figure 5: MetaTrader 5 Data Downloader Tool.

of employees; a shop has a database of stock; a library has a database of books. This can easily be stored in a spreadsheet too (e.g. MS Excel) and the majority of us know how Excel works, it is a staple of most people's working lives. It's (mostly) easy to use day-to-day, can be used to calculate columns, rows, averages, sort things alphabetically, and can produce a host of charts and graphs. Excel is also known as a flat-file system – it contains one record per line and does not contain an option to successfully search for a specific type of data. A phone is a good example of a flat-file system. Each new 'line' contains a new entry.

Short of producing graphs, SQL does those things too, but much better. This is due to SQL's predominant feature of RDBMS – Relational DataBase Management Systems. A relational database takes the information it contains and splits it into individual tables. Table 3 is the flat-file system, the Excel sheet. It is easy to see there are just two people, yet they consume five lines for their data. By using RDBMS this redundancy of data can be reduced by a process called normalisation. Developed in the early 1970's by Edgar Codd, normalisation allows the data to be transformed into various tables but with the emphasis on maintaining the data and reducing redundancy (EF Codd, 1970). Each table is linked to another via a 'composite key' such that any table can be

called upon to obtain the required data, and *only* that data.

Order number	First name	Surname	Address	Phone number	Product type	Colour	Size	Cost	Quantity	Total cost
59876	Rebecca	Johnson	49 Drew Road	029 381834	Jeans	Blue	28	£14.99	2	£29.98
59877	Rebecca	Johnson	49 Drew Road	029 381834	Shoes	Brown	6	£12.99	3	£38.97
59878	Rebecca	Johnson	49 Drew Road	029 381834	Jumper	Red	M	£29.99	1	£29.99
59879	Mushtaq	Aqbar	28 Lyttleton Lane	028 282738	Shirt	Blue	M	£33.99	3	£101.97
59880	Mushtaq	Aqbar	28 Lyttleton Lane	028 282738	Socks	White	6	£10.00	2	£20.00

Table 3: Flat-file system akin to MS Excel.

5.3. Java

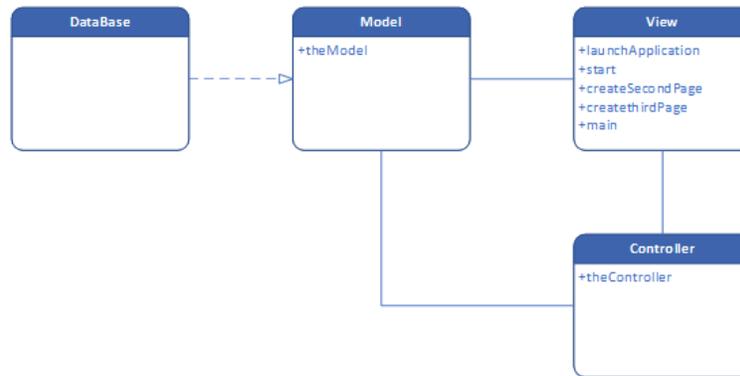


Figure 6: Software design of the three Java classes, with input from the Database.

There are a range of languages, around seven hundred, that are available to code MATI in. HTML, the language of the Web, is extremely versatile due to its ability to work in any operating system. Java was selected purely as personal preference to the authors. Unified Modelling Language is a way to visualise the layout of the code. MATI uses a style called MVC (Model, View, Controller) where each class controls just one aspect of the entire program. The UML diagram in Figure 6 shows the three classes in Java along with the database (indicating where the data is sourced from). The information inside each class are constructors and methods, these are small packets of code that operate unique parts of the overall program. For example, the data that is outputted to MATI should be refreshed periodically, this is carried out by the main method that calls the *'createThirdPage'* method.

5.4. Final MATI Prototype

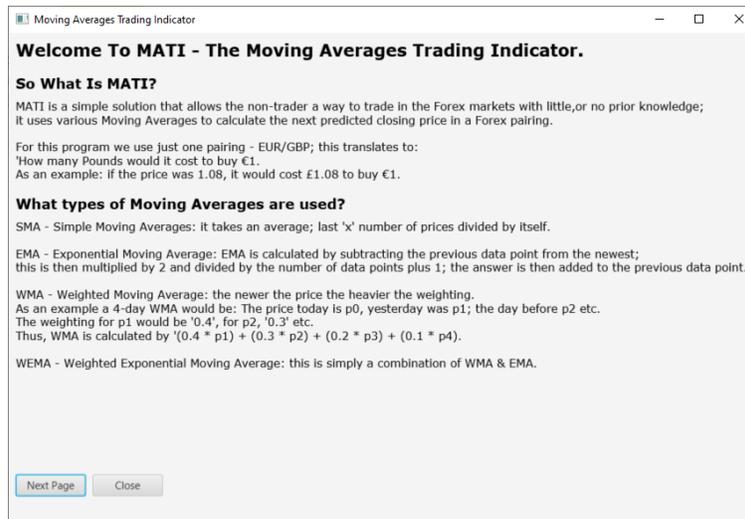


Figure 7: Page 1 of the final version of MATI.

It's a fairly common notion that the human brain performs differently from either side. The left side tends towards the logic and analytical data; the right side towards the more imaginative and visual. That idea holds for traders whose career is based around reading graphs; they have been taught to analyse and they have learnt how to interpret the various peaks, troughs, trends and signals that allow them to be successful. It does not hold though, for the non-trader. The non-trader can easily look at a graph and determine a dominant trend; but this is most likely to lead to a negative profit - they do not actually know what they are looking for. This is one of the reasons for a digital, numerical based approach. MATI takes the data from the graphs and presents it as a snapshot. As MATI is designed to be for scalping, the non-trader does not need to be aware of any other factors. It is quite literally *“get in; make a buck or two; get out”*.

The name MATI is an acronym derived from Moving Averages Trading Indicators. With MATI, the idea was to present some of those analytical trends, the moving averages, along with some error detection data, in a numerical format.

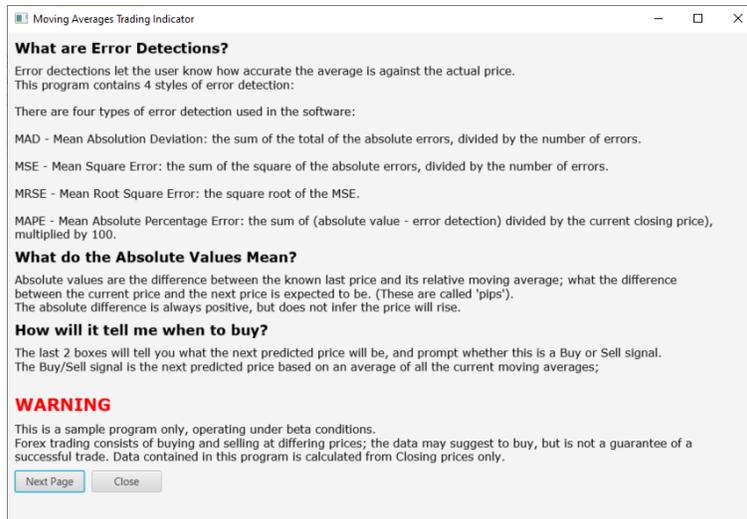


Figure 8: Page 2 of the final version of MATI.

This provides a quantitative data set to the non-trader that should be easier to understand. The end product also instructs the non-trader if it is a good time to trade or not. To achieve this, the final layout of MATI introduced a little colour to highlight certain more important areas. For example, the '*Last Trading Price*' is coloured blue and the '*Buy or Sell*' textbox is coloured green for a buy signal and red for a sell signal. Also, the last and next prices have been placed next to the buy/sell indicator so they are easier to read together. This can be seen in Figure 9. There were two extra pages added to MATI that prefixed the data, Page 1, Figure 7, introduces MATI to the non-trader and explains what the MA's are, Page 2, Figure 8, explains the ED's, absolute values, the buy/sell signals and a warning about the financial aspects of trading in Forex.

6. Research Design

This study, which took place at Cardiff Met University in April 2020, aims to give some insight into individuals' perception and engagement with the MATI application. Sixty participants from the age of eighteen plus years completed

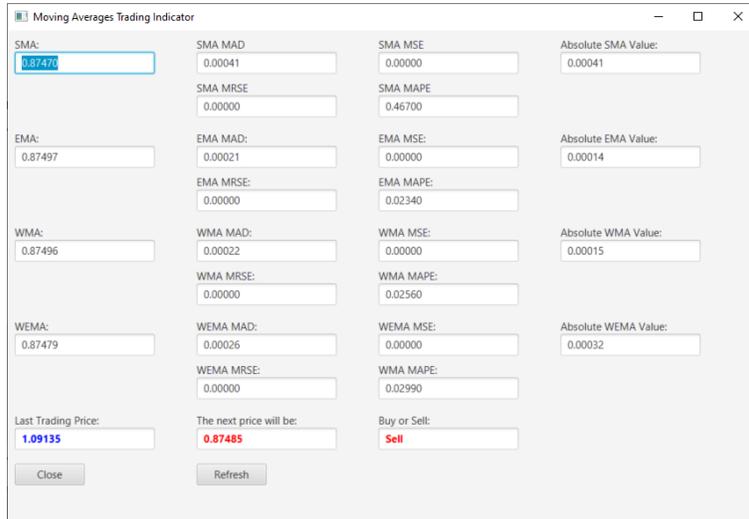


Figure 9: Page 3 of the final version of MATI.

the study. The study was conducted using the Qualtrics online survey software; this paper presents a quantitative and qualitative analysis of the online survey data.

Participants were first asked to interact with MATI for a series of trades, however, due to COVID-19 restrictions this occurred passively via an online video demonstration (Silcox, 2020). A sample set of data, Table 4, taken from MT5, was used to evidence the accuracy of MATI; this was also included in the online demonstration.

	Opened @	TimeFrame	Last Price	SMA	EMA	WMA	WEMA	Next Predicted Price	Buy / Sell	Closed @	Actual Next Price	High	Low	Result
14/04/2020	2120	4 Minute	0.86928	0.86972	0.86927	0.86936	0.86946	0.86945	Buy	2124	0.86940	0.86944	0.86922	Pass
14/04/2020	2124	4 Minute	0.86940	0.86969	0.86933	0.86935	0.86936	0.86943	Buy	2128	0.86930	0.86946	0.86927	Pass
14/04/2020	2128	4 Minute	0.86930	0.86963	0.86936	0.86932	0.86935	0.86941	Buy	2132	0.86923	0.86935	0.86918	Pass
14/04/2020	2132	4 Minute	0.86923	0.86956	0.86927	0.86929	0.86932	0.86936	Buy	2136	0.86907	0.86936	0.86903	Pass
14/04/2020	2136	4 Minute	0.86907	0.86945	0.86917	0.86920	0.86929	0.86928	Buy	2140	0.86919	0.86926	0.86887	Pass
14/04/2020	2140	4 Minute	0.86919	0.86936	0.86912	0.86917	0.86920	0.86921	Buy	2144	0.86931	0.86932	0.86919	Pass
14/04/2020	2144	4 Minute	0.86931	0.86932	0.86924	0.86922	0.86917	0.86924	Sell	2148	0.86941	0.86942	0.86931	No Change
14/04/2020	2245	3 Minute	0.86971	0.86968	0.86964	0.86964	0.86960	0.86964	Sell	2248	0.86978	0.86990	0.86971	No Change
14/04/2020	2248	3 Minute	0.86978	0.86968	0.86973	0.86970	0.86964	0.86969	Sell	2251	0.86980	0.87014	0.86963	Pass
14/04/2020	2251	3 Minute	0.86980	0.86967	0.86979	0.86975	0.86970	0.86973	Sell	2254	0.86973	0.86999	0.86969	Pass
14/04/2020	2254	3 Minute	0.86973	0.86967	0.86977	0.86976	0.86975	0.86974	Buy	2257	0.86989	0.86996	0.86961	Pass
14/04/2020	2257	3 Minute	0.86989	0.86969	0.86979	0.86981	0.86976	0.86976	Sell	2300	0.86944	0.86994	0.86942	Pass
14/04/2020	2300	3 Minute	0.86943	0.86967	0.86971	0.86967	0.86981	0.86972	Buy	2303	0.86968	0.86973	0.86942	Pass
14/04/2020	2303	3 Minute	0.86968	0.86968	0.86954	0.86966	0.86967	0.86964	Sell	2306	0.86985	0.86984	0.86975	Fail
14/04/2020	900	1 Hour	0.86953	0.87119	0.87004	0.87033	0.87054	0.87052	Buy	1000	0.87020	0.87050	0.86828	Pass
14/04/2020	1000	1 Hour	0.87020	0.87093	0.86993	0.86994	0.87033	0.87028	Buy	1100	0.87203	0.87338	0.86929	Pass
14/04/2020	1100	1 Hour	0.87203	0.87093	0.87053	0.87070	0.86994	0.87053	Sell	1200	0.87207	0.87384	0.87207	Fail
14/04/2020	1200	1 Hour	0.87207	0.87095	0.87205	0.87136	0.87070	0.87126	Sell	1300	0.87270	0.87345	0.87135	Pass
14/04/2020	1300	1 Hour	0.87270	0.87110	0.87232	0.87209	0.87136	0.87171	Sell	1400	0.87198	0.87311	0.87156	Pass
14/04/2020	1400	1 Hour	0.87198	0.87114	0.87241	0.87222	0.87206	0.87199	Sell	1500	0.87003	0.87238	0.86973	Pass

Table 4: Sample data of paper trades used to demonstrate MATI.

This was followed by an online questionnaire (comprising eleven quantitative and two qualitative questions) to capture data on their experiences. Participants responses were recorded on the Likert Scale, these responses could be in a form of agreement, likelihood or difficulty. Cardiff Met University Ethics Board approved the experimental procedure and participants provided online consent for study completion and the academic use of de-identified data. The questionnaire lasted approximately twenty minutes in duration plus ten minutes for the video demonstration.

6.1. Analysis and Discussion

In the first two questions, demographic data of the participants was collected. Of the sixty participants who completed the survey, 30% each fell into the ages ranges 18 - 34 years old, 35 - 49 years old & 50 - 64 years old with the remaining 10% being 65+ years old, Figure 10. The male to female ratio returned 36/24%.

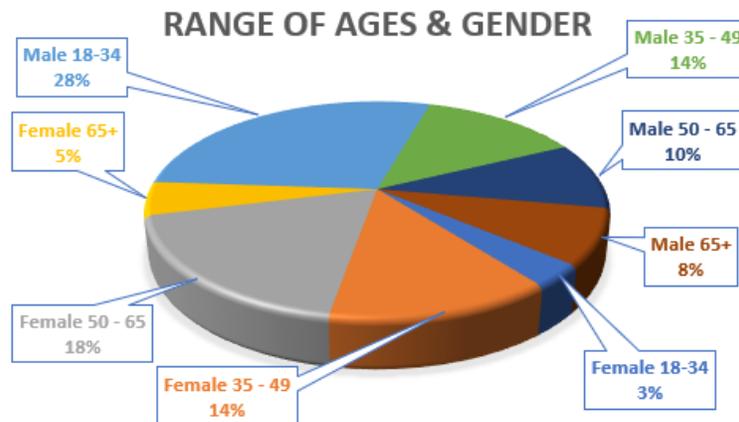


Figure 10: Questions 1 & 2 Responses.

The findings show that slightly more than half, thirty-two participants have no interests in financial trading, which bore out in their knowledge. Table 5 shows that twenty-one of those having "extremely bad" or "somewhat bad" knowledge and eight of the thirty-two participants declaring "neither good nor bad". Of the twenty-eight participants with an interest, only eight rated them-

selves to have good knowledge and a further thirteen having neither good nor bad. Thus, seven rated as having bad knowledge.

	Do you have an interest?		How good is your knowledge?				
	Yes	No	Extremely Bad	Somewhat Bad	Neither Good nor Bad	Somewhat Good	Extremely Good
Male	18 - 34	11	6	1	2	6	2
	35 - 49	6	2	3	1	1	1
	50 - 64	3	2	1	1	2	3
	65 +	3	3	1	1	2	1
	Total	22	14	7	7	14	8
Female	18 - 34	1	1	1	1	1	1
	35 - 49	4	4	2	2	2	1
	50 - 64	1	10	3	2	5	1
	65 +	3	3	2	2	1	1
	Total	6	18	9	5	8	1
Overall Total	28	32	16	12	22	9	

Table 5: Participant Interest and Knowledge of Financial Trading.

When reviewing gender, males have more interest at 61% to females at 25%. It also shows the younger the male seems to hold the most interest, although the participant numbers are too small for anything significant. The same correlation was not found for females. From all participants, only one female rated themselves as having an extremely good knowledge.

Age did not appear to be a contributory factor. Qualitatively, the authors wanted to understand why some of the participants had no interest in trading. For those that answered no to Question 4, we asked them to give a reason. Understandably, some people have no interest in certain activities and at least ten participants responded to having no interest in financial trading. Some commented on the risk whilst others on the perceived difficulty of understanding it:

- *"I would not know where to start", Participant 16*
- *"I don't understand it well enough", Participant 33*
- *"I don't understand it so I've never really looked into it. It sounds a bit like a shady business to me", Participant 37*
- *"Not really been enticed by it", Participant 1*

- "I believe the whole financial system is manipulated to allow only certain companies to succeed.", Participant 57
- "FX is very volatile - too easy to lose your shirt", Participant 53

These questions asked: "Have you ever used any trading platforms such as Trading 212, MetaTrader or FXCM?" and "How likely would you be to use this software [MATI] if you wanted to trade?" The latter question was to be answered following the online demonstration. The authors strategically included the earlier question of "Do you have an interest in any financial trading?" to see if participants previously negative responses could be changed. The legend for Figure 11 is in 2 parts:

- "Do you have an interest in any financial trading?" Yes or No
- "Have you ever used any trading platforms such as Trading 212, MetaTrader or FXCM?" Yes or No

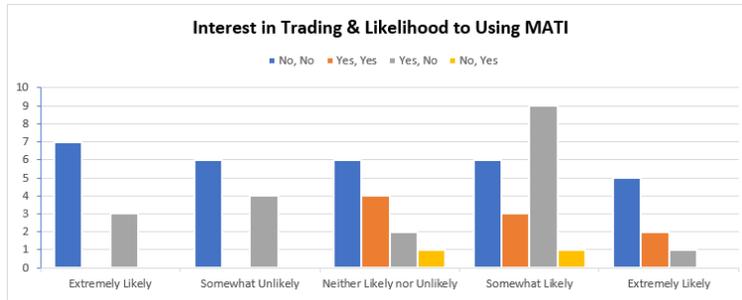


Figure 11: Outcome of participants interest in MATI.

The next part of the study was interested in participants feelings of the actual MATI software. From the findings, we can determine that 45% of participants expressed an interest in using the software after watching the demonstration. Whilst 33% of participants had no interest in using the software and 22% of participants were unsure. Probing the MATI design further, 47% of participants thought that it seemed easy to understand whilst 22% of participants were undecided. Unsurprisingly, those participants with no interest in financial trading

found it harder to understand the MATI than those who had an interest. Ultimately, we asked: *"Having seen the relative success of the software, how likely are you to use the software?"*, 50% of participants felt that they were somewhat or extremely likely to use the software. There was 27% of participants who were unsure and 23% that clearly stated no desire in using MATI.

7. Discussion

The MATI application has proved that a moving averages, digitally based system works. However, there is plenty more that can be incorporated in terms of engaging the general public in continual interaction with the application. As participants noted:

- *"Maybe not all the data being included all the time. Is an option to see it all or only the ultimate prediction"* Participant X
- Several participants wanted *"More colours.."*, *"...adding some colour would be a nice touch..."* Participant Y
- Most important was: *"...less indicators shown so the non-experienced trade[r]s will not get confused..."*, *"Have the data spread out"*, *"...adding a [legend] for beginners to understand everything by a single look"* Participant Z

In terms of the design, some participants struggled to read the font sizes. Others as we have seen, wanted more colour within the design whilst other participants mentioned the need for an application that was responsive to different screen sizes. As Participant 10 commented: *"The overall user interface is quite limited in it's design. The buttons could use formatting to add some accents to the interface. Adding some colour would be a nice touch. Even a small amount can make all the difference to a person."* Furthermore, the design has only been used on a 17" laptop screen which made it difficult for Participant 31: *"I struggled reading the font size, but probably because I'm using an iPad."* In terms of the quantity and arrangement of data on the screen, some participants felt they

needed more information. Whilst other participants clearly needed less. At the very least, the authors of this paper feel that there should be further research into the aesthetic and usability of MATI to ensure the interface is usable and engaging.

8. Conclusion

This research investigated how mathematical calculations, moving averages, could be presented to an individual in a manner that would aid but also engage them when trading in Forex. The first challenge was the development of an accurate online trading application. This was achieved by automatically sourcing the data from MT5, transforming it into SQL to then create the MA & ED indicators. This resultant data was then successfully passed to Java, whose code created the interface that became MATI. The second challenge lay in the design and presentation of this data and interface. As we have seen, 50% of participants stated their confidence and trust in using the MATI application.

MATI concentrated on informing the user on the direction the market was trending and was deemed a success if a buy signal resulted in a higher price than the current price, and a sell price resulted in a lower price. However, Forex operates on *spreads* which is the difference between bid and ask prices. Not only does a trader have to contend with the spread, they also have to understand how wide the spread is too. If the currency pairing is trading fast the spread will be small, a few points, however slower moving pairings could result in a far larger spread. Future versions of MATI would have to include buy/sell & spread data to be confident in its next prediction.

Indeed, in order to succeed as a viable piece of professional software, further upgrades to MATI will also include other forms of moving averages and ED's. But also with that, more technical processes like machine learning and/or cobots could be incorporated. Once produced, these can be integrated into MATI as dropdown menus so the user could select only the datasets they require. In conclusion, insights have been gained from this initial study that can contribute

to the future development of a more functional yet engaging and trustworthy MATI. It is our conviction that such a development will produce significant benefits to society, especially as more and more people have embraced Forex trading (alternative way to make money) as Covid-19 continues to take their jobs and erodes savings.

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