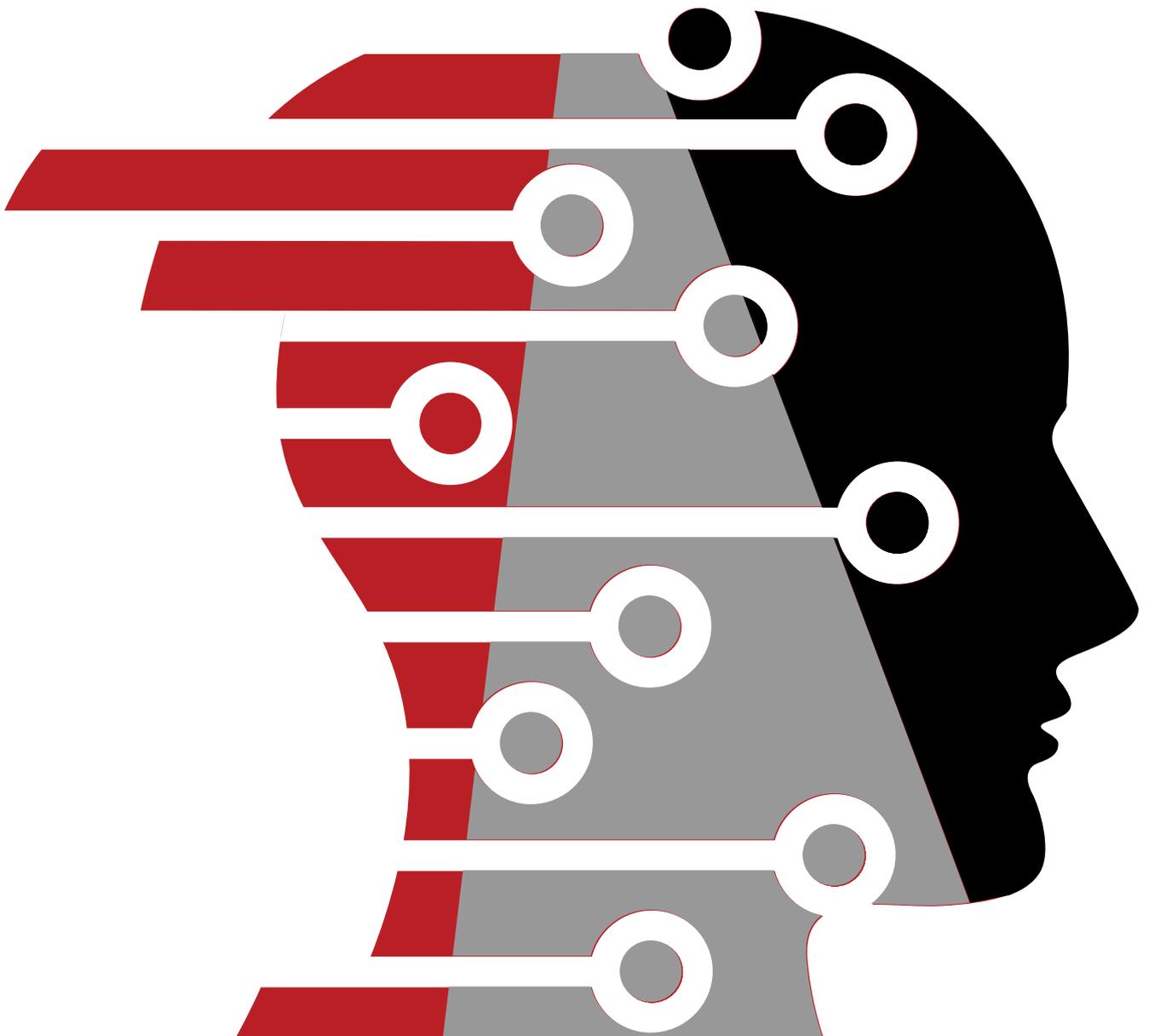


# THE SCIENCE OF FACT360<sup>TM</sup>



# INTRODUCTION

The quest for knowledge has always been a driving force for humankind concerning some of the greatest minds of all time. It is something that challenged Plato and in 380BC he scripted 'Meno', a Socratic dialogue attempting to define virtue.

*How do you enquire into that which you know not? Meno asks Socrates. What will you put forth as the subject of enquiry?; And if you find what you want, how will you ever know that this is what you did not know?* Plato then summarised the query in what has become known as Meno's Paradox (Fig. 1)

Plato responded to the paradox in his Theory of Recollection stating *knowledge exploration and discovery is merely our recollection of timeless forms from a period long before our immortal souls were imprisoned inside our physical bodies.*

Slightly more pragmatically, FACT360 reveals knowledge applying AI and unsupervised Machine Learning to the millions of email and messages circulating throughout an organisation.

This paper outlines some of the leading-edge scientific techniques FACT360 uses and organisations can apply to their data as they search for the knowledge to drive their organisations forward.

## INSPIRATION

During the second world war, Bletchley Park in the UK became famous for cracking the Enigma code and decrypting enemy messages. But alongside codebreaking, the top-secret intelligence division also developed 'traffic analysis' – producing intelligence by examining the characteristics of enemy messages, such as volume, direction and time, rather than the message content itself. It was George Welchman who is credited with developing this technique and its power can be inferred from the fact that many research papers on traffic analysis remain classified today.

The work of George Welchman in Hut 6 in Bletchley Park was the inspiration behind FACT360 as the company set about investigating what happens when the same techniques are deployed on modern communication networks.

### Figure 1: Meno's paradox

If you know what you're looking for, inquiry is unnecessary.

If you don't know what you're looking for, inquiry is impossible.

Therefore, inquiry is either unnecessary or impossible.

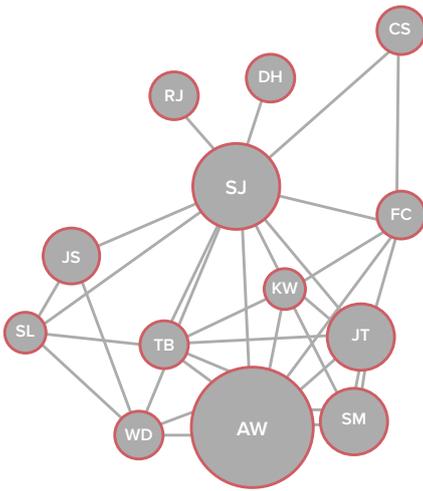
*Plato 380BC*



# APPLIED SCIENCE

## TRANSACTIONAL ANALYSIS

FACT360 has built on the ideas of Welchman's traffic analysis developing a method that treats each communication as a 'transaction' with the subsequent transactional analysis identifying the key people within a communication network without analysing the content of messages themselves.



**Figure 2:** Transactional Analysis identifies the key players in a network without analysing the content of messages

FACT360 assigns a numerical value to an individual that is calculated recursively based on the individuals' communication patterns (Fig.2). This value can be seen as a proxy for 'Prestige' within the organisation and reflects the volume of communication a person receives and the Prestige of the person sending a message. Receiving a communication from a high Prestige person increases in turn the recipient's own Prestige. This analysis creates a fact-based organisational model determined by activity and not reputation so organisations can gain as much insight based on what employees do as what they say.

FACT360 can provide additional insight using transactional analysis and has developed a metric to act as a proxy for 'expertise'. On a communication network, a 'hub', that is an employee communicating with many different authorities, may represent someone who knows where to find information within an organisation. And by extension, 'expertise' can be ascertained by identifying the users who receive communication from a high number of hubs.

To provide further insights from communication networks, FACT360 also applies Natural language processing (NLP) techniques to understand the context of messages.

## NATURAL LANGUAGE PROCESSING

Natural language processing (NLP) is a subfield of artificial intelligence concerned with computers' ability to understand written and spoken language and is used by FACT360 to generate contextual insights from communication flows.

Used in conjunction with Transactional Analysis, it enables FACT360 to use unigrams and bigrams to uncover more detail by grouping items that share characteristics.

## UNIGRAMS AND BIGRAMS

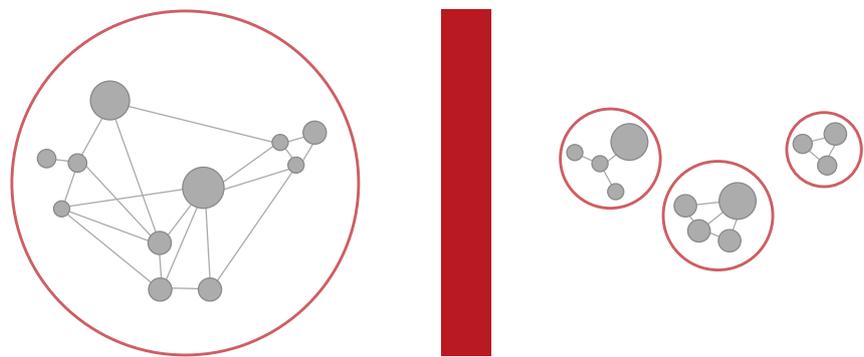
A bigram is simply a sequence of two adjacent elements in a string of data and for FACT360 it is effectively a sequence of two words that exist in a communication. In the same way a unigram is effectively a single word.

Analysing bigrams and unigrams within messages allows FACT360 to identify particular topics that are being discussed. It is also possible to use 'clustering' techniques to group messages and communications together that share similar characteristics in order to identify groups of individuals discussing the same topic.

The levels of data involved in a typical FACT360 analysis make clustering algorithms essential and are key to making sense of seemingly amorphous communication flows.

Alongside classical concept clustering methods, FACT360 deploys state-of-art methods to cluster more semantically interesting sets, even if identifiers for those sets are not explicit in the data. It has been used very effectively to identify teams within an organisation and show how well an organisation is functioning. In addition, FACT360's research has shown it is possible to make predictions based on teams behaviours and identified 'silos' of teams i.e. teams breaking away from the organisation as a whole as a good indicator of a failing company (Fig. 3).

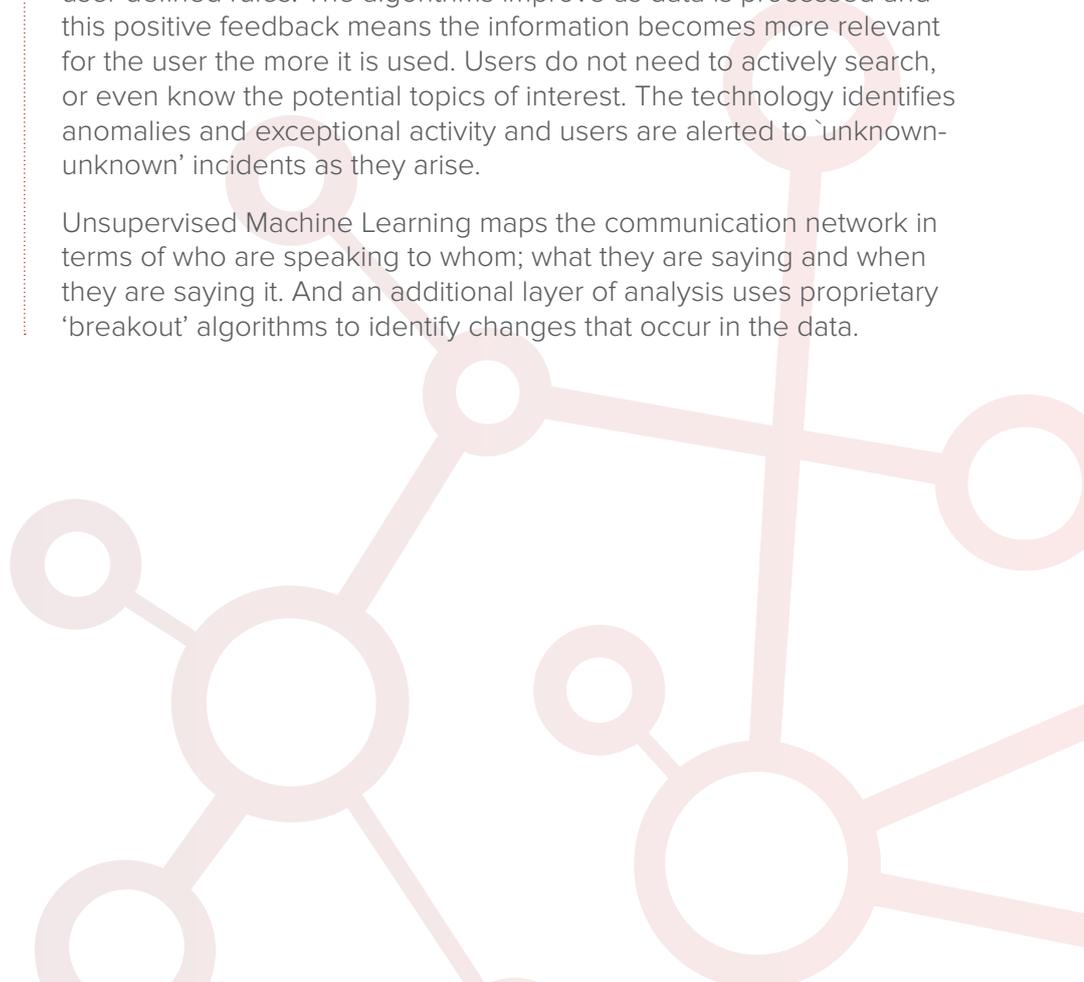
**Figure 3:** 'Silos' of a communication network has been shown to be a precursor to a failing organisation



## UNSUPERVISED MACHINE LEARNING

FACT360 applies unsupervised Machine Learning so complex analyses can be carried out without the need for manual searching or user defined rules. The algorithms improve as data is processed and this positive feedback means the information becomes more relevant for the user the more it is used. Users do not need to actively search, or even know the potential topics of interest. The technology identifies anomalies and exceptional activity and users are alerted to 'unknown-unknown' incidents as they arise.

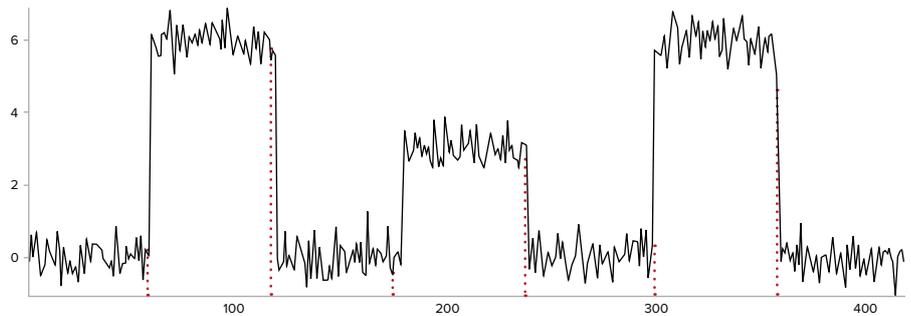
Unsupervised Machine Learning maps the communication network in terms of who are speaking to whom; what they are saying and when they are saying it. And an additional layer of analysis uses proprietary 'breakout' algorithms to identify changes that occur in the data.



## BREAKOUT ALGORITHMS

FACT360 has developed its own leading-edge statistical analysis to identify changes that occur along a communication timeline. By analysing the historical baseline of any situation, FACT360 automatically identifies events that differ significantly from the norm.

**Figure 4:** The dotted lines mark breakout points in the time series (i.e. where something has changed significantly). FACT360's breakout detection algorithms identify these events without direct human intervention



Even with data plotted on a graph it can be difficult to spot significant events manually but FACT360's algorithms are able to identify statistically relevant changes when compared with the historical average.

## CONCLUSION

Using the latest AI and unsupervised Machine Learning technology to analyse communication flows, FACT360 uncovers information that is critical to organisations or investigations generating results that are impossible to achieve in other ways.

Underpinned by leading edge academic research, its practical solutions uncover the 'unknown unknowns' and identify exceptional activity without the need for user-defined rules or custom configuration.

It was over 2000 years ago that Plato formulated Meno's paradox when defining virtue and while patience may be a virtue, organisations do not need to wait to apply transactional analysis, NLP and unsupervised machine learning to discover their own 'unknown unknowns'.

Get in touch to see how FACT360 can help uncover the critical information that exists within your organisation.

## ABOUT FACT360

FACT360 is a UK company formed in 2017 by leading academics and experts in Artificial Intelligence, Unsupervised Machine Learning, Artificial Neural Networks and Swarm Intelligence. It is pioneering the use of AI and unsupervised machine learning to help organisations find critical information that exists within their communication flows and is widely used in fraud and insider threat investigations.

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