

# Can you catch the perpetrator of a hit-and-run in an ego-net?

Nicola Headlam

## Introduction

This blog argues that Social Network Analysis (SNA) can be deployed as an investigative tool –using the hit and run of Matt Crawford in *The Archers* on 29<sup>th</sup> October 2017 as a worked example. It explains the context for the incident, proposes that SNA, using graph analysis package YeD, can help in narrowing the field of those who may have deliberately or accidentally run over Matt and that these tools have more in common with the careful approaches of classic detective fiction as espoused by Miss Marple created by Agatha Christie. It suggests that only a few of the tropes of classic detective fiction apply to village law enforcer Harrison Burns and that he may need some help drawing on the methods of Miss Marple but further that a network approach might aid his investigations. Using the SNA method of an ego-net focussed on Matt Crawford it explores those with network centrality by both motivation and circumstance and explores four further dimensions for the core characters which may rule them in or out of involvement considering (1) their strength of their connection with matt, (2) whether they are able to drive and with access to a car. (3) Whether they were in the vicinity at the time, and whether through prior behaviours they have demonstrated either (4)untruthfulness or a flexible moral compass.

It concludes that Matt Crawford's ego-net contains 55 people, from which there is a longlist of 29 possibilities and that perpetrator must be from within a defined shortlist of 5 of whom 3 have centrality, motive and opportunity (suggesting intention by the perpetrator)and 2 have only centrality and opportunity (leading to the conclusion that the collision was more genuinely accidental )

## Context

### #mattsplat

It has been well flagged that Matt Crawford has been generally stirring things up in Ambridge since his most recent return this year. It has been played with extreme ambiguity whether his motives have been revenge, reparation or reunion with Lilian Bellamy. And while at times his feelings for Lilian Bellamy have seemed quite genuine there are creepy/controlling overtones in trying to extract her from her new and ostensibly stable partnership with Justin Elliot. As *Archers* listeners seasoned by the ambiguities of the Helen and Rob relationship as it crystallised towards the sinister we are hyper-sensitive to the moments where romantic actions or gestures shade into the manipulative, or even coercive. (raiding a ladies' changing room in New Street John Lewis is definitely more stalkerish than romantic in my humble opinion.) So then, in his (many) appearances this year<sup>1</sup> Matt's behaviour has been quite erratic and as he lies in intensive care there are clues and mis-directions pointing in all directions within Ambridge. It has to be said though – to quote DumteeDum 195 "ITS OFFICIALLY OFFICIAL, MATT IS A TOTAL BASTARD."<sup>2</sup> There had been rampant speculation on twitter that the Hunt Ball would spell the demise of Matt but the linking of this storyline with the long running hints about speeding and road safety is a cunning move. (A 'who shot JR' scenario would be too much for us so soon after Helen's acquittal for the attempted murder of her erstwhile torturing husband Rob.) Rural roads are more dangerous for pedestrians due to speeding, poor lighting and poor visibility and according to the Royal Society for the Prevention of Accidents (RoSPA) 58% of road fatalities occur on rural roads.<sup>3</sup>

---

<sup>1</sup> See dum tee dum stats

<sup>2</sup>

<sup>3</sup> <https://www.rospa.com/rospaweb/docs/advice-services/road-safety/drivers/rural-road-safety-factsheet.pdf>

## Miss Marple in Ambridge

In common with the unravelling of the Helen and Rob storyline as listeners we will follow a criminal investigation through to its judicial conclusion, and as the wheels of justice turn the question of “what happened” will be revealed. There has been a lot of concern of late about the work-rate of village copper Harrison Burns, as he has seemingly devoted the majority of the summer to necessary subterfuges and glass-ceiling busting in his captaincy of the village cricket team. He is, however the long arm of the law as it extends to the village. And it is our duty as academic archers to give him a hand.

Exploring the numerous well-trod tropes within detective fiction listed<sup>4</sup> as;

- Maverick private detective
- Hardboiled veteran cop whose seen it all (and drinks, has a bad marriage, etc)
- Amateur information gatherer (journalist, novelist,etc.) thrown into the case
- The rookie (getting guidance from the more wise)
- The specialist (crime scene investigator)
- The consultant
- The magical (psychic or eidetic memory, or something of the like)
- The team
- The agent/ex-agent
- Any of these characters plus mental disorder

It is possible to categorise our detectives as primarily demonstrating the following types;

Harrison Burns	Endeavour Morse	Miss Marple	Sherlock Holmes
The rookie	Hardboiled veteran cop whose seen it all	Amateur information gatherer	Maverick private detective

Although it is far from well-established within crime-scene analysis I would like to add my own expertise as a social network analyst as a new possible method for investigating a complex criminal phenomenon.

As has been pointed out by Lucy Freeman and Riofield Brown this story has the characteristics of *Murder on the Orient Express* whereby everyone has motive and opportunity. The obvious outsider status of investigator Hercule Poirot leads to his use of deductive reasoning. However I would like to suggest a different Agatha Christie character would be of more use in the context of Ambridge as I firmly believe that if Miss Marple were operating today she would abandon her knitting needles in favour of social network analysis software. This is somewhat supported by those who argue that this character is pivotal as regards her linked gendered skills of keen observation and embeddedness within the milieu of the crimes she investigates

*what the Miss Marple novels propose is that **there is a logic which is structured around the minutiae of life which can nevertheless inexorably reach into the very depths of human society and the human psyche. And they suggest that women, particularly old women, because they are attuned to the trivia of existence, are therefore endowed with logical powers which make them ideal arbiters of justice [...]**" (p.34). In this sense, in a logical manner, her analyzing the basic features and the trivial aspects of her society and the important clues about human psychology **enables her to eliminate chaos in society, to establish order and to find out the mystery behind criminal cases.** Thus, it should be emphasized that her being a member of the society illustrated in Christie's novels, is also of great importance and strengthens her ability to reveal the criminals. **Since she comes from the village and belongs to the setting in which the crime has been committed, she***

<sup>4</sup> <https://www.quora.com/What-are-the-characteristic-tropes-and-plot-templates-used-in-detective-fiction>

*can see the inner world of the ordinary characters, their life style and their typical characteristics.*(Kosgelou, 2011)<sup>5</sup>

Network analysis is way of rendering the 'minutiae of life' into 'structures' and patterns in order to 'eliminate chaos'.

Despite how well-suited network methods may appear to be in the analysis of a hit and run of this type they methods are not well used within criminology and especially not in the field of crime scene investigation intelligence

Existing concepts from the discipline of network analysis have been shown to be relevant to the analysis of criminal intelligence. These include **several different notions of centrality and of equivalence, and the concept of weak ties.** ...The law enforcement community, being largely unaware of the methods and concepts developed within the discipline of network analysis, has not yet had the opportunity to enunciate its needs for more sophisticated tools.<sup>6</sup> (Sparrow, 2001)

The 'sophisticated tools' of social network analysis are made far more accessible since the advent of YeD graph illustrator where networks can be simply generated and the majority of the analysis conducted automatically.

So, Miss Marple-style let us apply some network analysis (SNA) to the problem of who was behind the wheel in the episode aired on Sunday night 29<sup>th</sup> October.

## Who ran over Matt Crawford?

### Known knowns

There are a number of things that we know about the night in question: Matt was drinking heavily in The Bull, drunk-dialling Lilian, making a big fuss about the security of his luggage with barmaid Nic and heading for a flight for which a taxi was called. He staggered outside, at Kenton's suggestion (heading drunkenly for Grey Gables?) and was hit by a car. A driver then saw him hurt and drove off, closing their car-door behind them. A "Hit and Run" we are told on Monday 30<sup>th</sup> October that 'a taxi driver' raised the alarm and got him to hospital where Lilian was contacted as his next of kin, presumably from details in his passport (which he must have had on him to fly).

Always a slightly Marmite character Matt first appeared to unsettle Ambridge in 1994 engaged in business dealings with Brian. Of late he has;

- wound several Archers into a frenzy, seemingly for fun; Tom Archer (1) and Shula Hebdon-Lloyd (2)
- Been up and down in the affections of 'the equestrian set' always peripheral to Ambridge Hugo Melling (3), Latif Hussein, (4) Mandy Beesborough (5) and tested their loyalties to Justin Elliot (6)
- Anisha (7) (famously overconfident in her ability to 'eat men like Matt Crawford for breakfast') had been making her partner Alistair Hebdon-Lloyd (8) deeply uncomfortable by working for Matt on Veterinary checks on racehorse, this predated the run of equine misfortune and muck-spreading for which Shula Hebdon-Lloyd had blamed Matt.
- had fisticuffs with James Bellamy (9), (Lilian Bellamy's (10) son) and Adam Macy, (11) who had lied about the altercation to his partner Iain Craig, (12) As well as recently with Justin. Most recently in a scuffle at the Bull

In short, the 12 characters above had some recent motive for offing Matt. Or at the very least, not reporting a near-fatal accident in which he was involved

<sup>5</sup>[https://www.academia.edu/14153200/Gender\\_and\\_Detective\\_Literature\\_The\\_Role\\_of\\_Miss\\_Marple\\_in\\_Agatha\\_Christie\\_s\\_The\\_Body\\_in\\_the\\_Library](https://www.academia.edu/14153200/Gender_and_Detective_Literature_The_Role_of_Miss_Marple_in_Agatha_Christie_s_The_Body_in_the_Library)

<sup>6</sup> [https://sites.hks.harvard.edu/fs/msparrow/documents--](https://sites.hks.harvard.edu/fs/msparrow/documents--in%20use/Application%20of%20Network%20Analysis%20to%20Criminal%20Intelligence--Social%20Networks--1991.pdf)

[in%20use/Application%20of%20Network%20Analysis%20to%20Criminal%20Intelligence--Social%20Networks--1991.pdf](https://sites.hks.harvard.edu/fs/msparrow/documents--in%20use/Application%20of%20Network%20Analysis%20to%20Criminal%20Intelligence--Social%20Networks--1991.pdf)

## Deep Background

There net widens, however, when you look more deeply into Matt's chequered past with many other characters;

- His longest-standing relationship in Ambridge is a business one with Brian Aldridge (13) the peripheral BL/Amside property people Stephen Chalkman (14) was imprisoned with Matt for mortgage fraud, Annabel Schrivener (15) who chaired the board of BL deposed Matt. Anthea (16) originally worked for Matt – could she have been cherishing a murderous grudge?
- He trapped (reformed) compulsive gambler Alistair into a scheme involving horse-doping using leverage won at the poker-table. The episode sorely tested his relationship with Shula.
- He has no known relatives, He found a long-lost brother Paul only for Lilian to fall in love with him and for Matt to be heavily implicated in Paul's death from a heart attack.
- He does have an ex-wife(17), demonstrating a life-long pattern Lilian hooked up with Matt when he was a married man

These characters, then might hold long-running antipathies towards Matt.

## Speedwatch

A second possibility is that the above 'bad blood' is irrelevant as the hit and run was a complete accident, caused by a motorist hitting a drunk man in the dark on a rural road. There has been endless flagging of the treacherous problems of speeding in Ambridge in recent times. Lynda, Jennifer and Jenny have been co-ordinating speedwatch with volunteers of varying enthusiasm including Jim Lloyd.

Freddie (18) and Lily Pargetter(19) have been learning to drive, severely ageing their uncles, David Archer (20) and Kenton Archer(21) in the process, Brian Aldridge famously splatted Peggy's cat Bill, necessitating the replacement Hilda Ogden (whose bloodlust has not, as yet extended to running over humans) Meanwhile Rex Fairbrother (20) has been flogging some platform private hire vehicle all over the countryside and his brother Toby Fairbrother (21) offered to step into the breach whilst Rex and Anisha are away in Scotland. Shula's references to Graham(22) the locum vet covering Anisha's work being hopeless with technology could be a tenuous link but he was on call on the night of the ball, as he had swapped so that Alistair could attend. In the case of the collision being a more genuine accident we are left to speculate on who would be self-serving enough to leave an injured and possibly dying man in a hedge? People with a track record of dishonesty perhaps?

## Ball-goers

As we are unclear at this point on timings it is unclear whether characters having the alibi of the Hunt Ball are exonerated or whether leaving the event by car would place them on a collision course with the drunken Matt Crawford.

The following characters were mentioned at the Ball; Shula, Iain, Elizabeth (23), Chris Carter (24), Christine (25), Lily, Freddie, Noluthando (26), Jenny(27), Phillip Moss (28), Alistair 'throwing alarming shapes' with Jennifer and, of course Adam and Iain (catering) Though Lilian and Justin were very visible (Justin making the presentation of the raffle prize to Christine Barford) As we heard both Adam and Justin had in fact left by car.

## The Bull

As well as Kenton Archer showing remarkable psychological insight in conversation with Justin. Nic Grundy (29) was finishing her shift behind the bar and presumably off home by car... having been a silent for a long time it would be bad luck indeed for her to pipe up in order to be so cruelly used in this sorry story.

## The Longlist

So then, worked out in this way the longlist extends to 29 people (*Murder on the Orient Express* only had 13 suspects and that is 274 pages long...) And the ego-net shows how they are connected together and with centrality applied. (see appendix 1 for list of 29)

# The Ambridge Network

## Ego-nets

In earlier work I have focussed on the role of kinship networks in Ambridge<sup>7</sup> and presented on the various ways in which weak ties combine in order to re-order power relations at Academic Archers 2017<sup>8</sup> Positting the Headlam Hypothesis – that ‘The Archers are dead, long live the network.’ This argues that over time the kinship network will weaken in framing power and authority in the village to be supplanted by the far more usual forms of capital which govern social life. *While the **Core** Ambridge network shows 75 people linked by blood or marriage there are characters with closer relations than others.*

This short piece, however, is solely focusses on the ego-net of Matt Crawford. As recently remarked by Shula Matt ‘would need a second seat at the table for his ego’ but an ego-net is a specific form of SNA based on one person’s connections, with the subject at the centre of the network linked to the other nodes by historic, intimate, difficult or even criminal ties.<sup>9</sup>

*Recent work has demonstrated that many social networks, and indeed many networks of other types also, have broad distributions of vertex degree. Here we show that this has a substantial impact on the shape of egocentered networks, i.e., sets of network vertices that are within a given distance of a specified central vertex, the ego. This in turn affects concepts and methods based on ego-centered networks, such as snowball sampling and the “ripple effect.” In particular, we argue that one’s acquaintances, one’s immediate neighbors in the acquaintance network, are far from being a random sample of the population, and that this biases the numbers of neighbors two and more steps away (Newman, 2001)*

In the brilliantly-named ‘Ego-centered networks and the ripple effect — or — Why all your friends are weird’ Newman explains that an ego-nets. All networks are built from nodes and ties which must be strictly defined

## Nodes

In order to map this network it is important to define nodes (in this case as people) who meet the following criteria

- Any character connected to Matt (strong negative connections denoted by a star)
- With a car and able to drive
- In the vicinity
- With a flexible moral compass (ie has lied recently)

## Ties

As we have already shown suspects may be either possessing a strong motive which would mean any character with strong ties with Matt Crawford. (positive or negative immaterial, just strong) or accidental whereby any character with a driving licence/car could be under suspicion, or circumstantial: Anyone driving around the village in the wrong place at the wrong time.

## Crawford ego-net

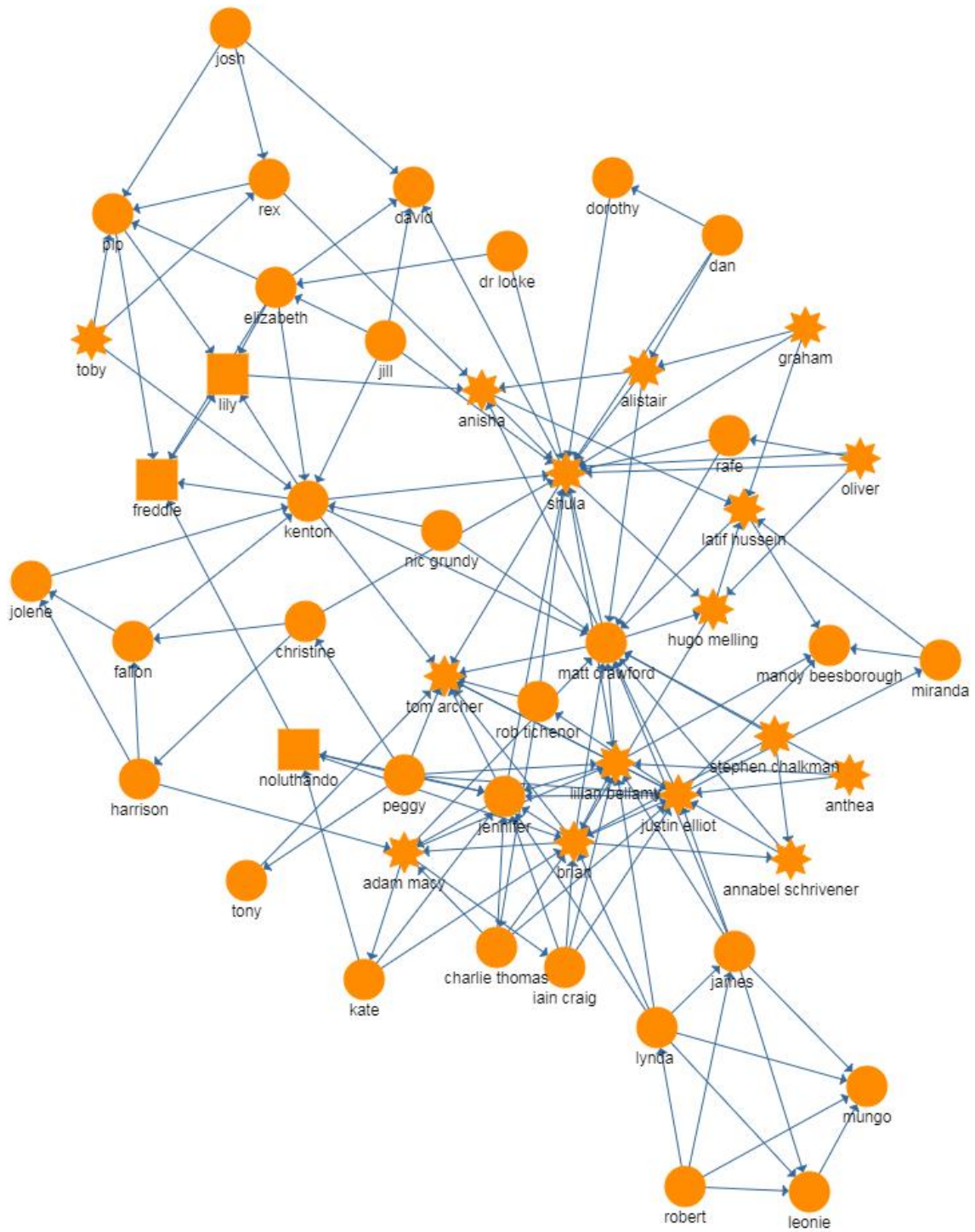
Figure 1 shows the full ego-net for Matt Crawford, with characters sorted for their centrality. The full ego-net has 55 characters with people with possible motive or opportunity represented by stars and others as circles.

---

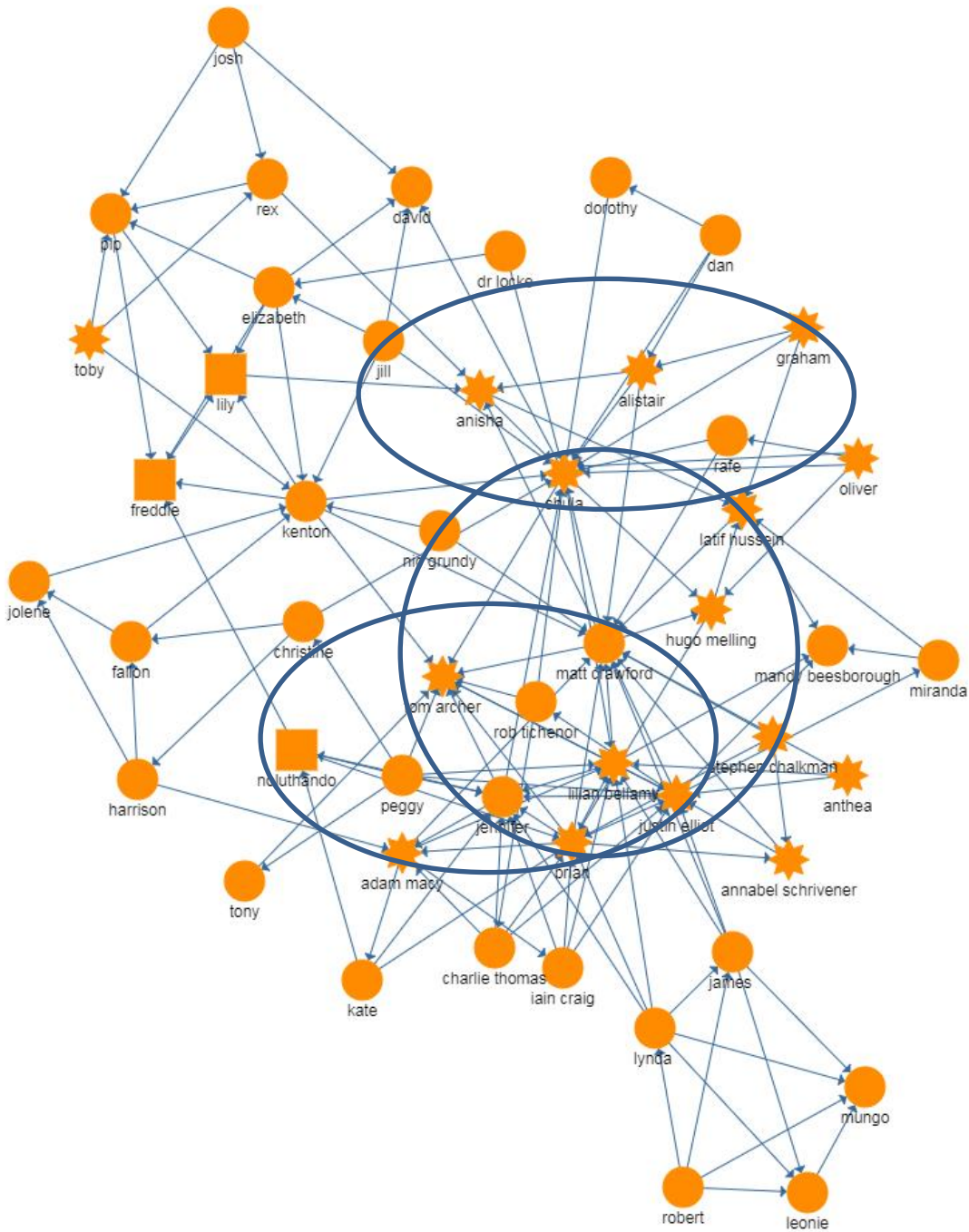
<sup>7</sup> Headlam, 2017 Kinship Networks in Ambridge, Custard Culverts and Cake eds Courage & Headlam :Emerald

<sup>8</sup> Web link

<sup>9</sup> <https://arxiv.org/pdf/cond-mat/0111070.pdf>



Map 2: Sets of Prime Suspects



Having said that the 'full' ego-net shows up 55 people and that the longlist is of 29 names we can explore the sets .

### Getting to the shortlist

Table 2: 3 sets of possibilities

Set 1 Mixed Set, centrality,motive and opportunity (8)	Shula, Latif, Tom, Hugo, Stephen C, Justin, Lilian, Brian
Set 1 Mixed Set, with centrality and opportunity (3)	Nic Grundy, Rob, Jennifer
Set 2 Family, centrality, motive and opportunity (5)	Tom, Lilian, Justin, Brian, Adam
Set 2 Family with centrality and opportunity (1)	Jennifer
Set 3 Vet/Hunt with centrality, motive and opportunity (4)	Shuna, Anisha, Alistair, Graham
Set 3 Vet/Hunt with centrality and opportunity (1)	Rafe

There are 22 nodes within the three sets identified above we will look at the likelihood of each set in turn in

## Set 1

A mixed set combining centrality, motivation and opportunity

Shula, Latif, Tom, Hugo, Stephen C, Justin, Lilian, Brian
Nic Grundy, Rob, Jennifer

**Of these only Tom, Justin and Nic had opportunity**

## Set 2

A Set of family-members

Set 2 Family, centrality, motive and opportunity (5)	Tom, Lilian, Justin, Brian, Adam
Set 2 Family with centrality and opportunity (1)	Jennifer

**Of these only Tom, Justin and Adam had opportunity**

## Set 3

A set of vets and hunt people

Set 3 Vet/Hunt with centrality, motive and opportunity (4)	Shuna, Anisha, Alistair, Graham
Set 3 Vet/Hunt with centrality and opportunity (1)	Rafe

**Of these only Graham could have been on the scene**

## Shortlist

Following this logic, then allowing for network centrality, motivation and opportunity then the perpetrator must be one of the following people; Tom, Justin, Adam or Nic Graham. Evidently Nic Grundy or Graham would be more accidental and the others more intentional...

	Connection with matt	Car? Driver	In the vicinity?	Flexible moral compass
Tom Archer (1)	Strongly negative, Matt meddled in the sale of land to Justin Elliot and made Tom look ridiculous	Yes to both	In the Bull 'staring daggers' at Matt	Mostly lies to himself – jilting Kirsty and absconding to Canada showed moral cowardice
Justin Elliot (6)	Had gone to look for Matt in anger, was talked down to a degree by Kenton	Yes, had driven from Grey Gables to The Bull, putting him on the right road but earlier in the evening. Did he leave the pub on foot for fresh air?	Seen by all at the Hunt Ball making the presentation of the cruise to Christine, slipped off without even saying goodbye to Lilian	Tough business negotiator does have high profile and focus for protest. Has been softened by relationship with Lilian.
Adam Macy (10)	Has been embedded in Lilian/matt/Justin love triangle throughout. Had fist fight with Matt in response to homophobic	Yes to both	Was driving his and Iain's car home from the ball at the time...	History of infidelities and has got tied in knots covering these up. Very mixed feelings about having children with Iain. Covering over assault of Matt as lied to Iain



	slurs, lied about his incident to Iain			
Nic Grundy	We have no evidence of any relationship beyond bar staff/customer	Yes to both	Was finishing her shift at The Bull and presumably going to relieve her babysitter (Emma?)	Quite a straight-shooter. Driving away from the scene of a collision would seem uncharacteristic – if she were in shock
Graham	We have no idea	Yes to both	Definitely the on-call vet on the night as covering for absent anisha and ball-going Alistair, backstory involving problems with technology reported by shula... could have had satnav problems	We have no idea

Other 'pure accident' possibilities are on the longlist of 29, such as Toby Fairbrother who may have been covering his brother's taxi shifts and who new assume to be generally feckless and careless however he does not assume the network centrality of the 5-strong shortlist. Irrespective of their guilt or innocence the accident has the potential to disrupt the lives and relationships of this whole shortlist , albeit in very different ways.

## Conclusion

We have seen then that an investigator of the "Amateur Information Gatherer" type (such as Miss Marple created by Agatha Christie) could well update their skillset by taking a rudimentary course in Social Network Analysis (SNA) Whether managing such complexities are possible, however for the 'rookie' type investigator exemplified by PC Burns remains to be seen. We have worked through the wide ego-net of 55 people through a longlist of 29 and further narrowed the field of those who may have deliberately or accidentally run over Matt Crawford. Narrowing the field to Tom, Adam or Justin possessing centrality, motive and opportunity (suggesting intention by the perpetrator) and Graham and Nic Grundy based on more circumstantial factors and weaker motives. We anxiously await the reveal.

Appendix 1: Table 3 The driver of the car must be one of these 29 people

1	Tom Archer
2	Shula Hebdon-Lloyd
3	Hugo Melling
4	Latif Hussein
5	Mandy Beesborough
6	Justin Elliott
7	Anisha Jayacody
8	Alistair Hebdon-Lloyd
9	James Bellamy
10	Lilian Bellamy
11	Adam Macy
12	Iain Craig
13	Brian Aldridge
14	Stephen Chalkman
15	Annabel Schrivener
16	Anthea
17	Ex-wife
18	Freddie Pargetter
19	Lily Pargetter
20	David Archer
21	Kenton Archer
22	Graham Locum
23	Elizabeth Archer
24	Chris Carter
25	Christine Barford
26	Noluthando Madikane
27	Jennifer Aldridge
28	Philip Moss
29	Nic Grundy

Appendix 2: working through motive and opportunity from those with centrality

	Connection with matt	Car? Driver	In the vicinity?	Flexible moral compass
Tom Archer (1)	Strongly negative, Matt meddled in the sale of land to Justin Elliot and made Tom look ridiculous	Yes to both	In the Bull 'staring daggers' at Matt	Mostly lies to himself – jilting Kirsty and absconding to Canada showed moral cowardice
Shula Hebdon-Lloyd (2)	Driven to apoplexy by Matt. Has been public and voiciferous about her hatred of him	Yes to both	NO As host of the Ball at Grey Gables would presumably have been last to leave	Always open to charge of hypocrisy and sanctimoniousness. Lied about the hunt sab 'to protect the hunt' and her crush on Dr Locke
Hugo Melling (3)	Employer	Don't know	No – did not attend hunt ball to present prize no reason to be in Ambridge	Don't know
Latif Hussein (4)	Racing contact	Don't know	Not mentioned	Don't know
Justin Elliot (6)	Had gone to look	Yes, had driven from	Seen by all making	Tough business negotiator

	for Matt in anger, was talked down to a degree by Kenton	Grey Gables to The Bull, putting hi8m on the right road but earlier in the evening. Did he leave the pub on foot for fresh air?	the presentation of the cruise to Christine, slipped off without even saying goodbye to Lilian	does have high profile and focus for protest. Has been softened by relationship with lilian.
Anisha (7)	Mixed, horrified by revelations about the gambling past	Yes to both	NO – in Scotland on compassionate leave necessitating the hiring of Graham	White lies – drinking comp with Jazzer for example
Alistair Hebdon-Lloyd (8)	Strongly hostile due to history of gambling and horse doping precipitating breakdown. Strong stressor	Yes to both – drinking at ball as was ‘throwing shapes’	We don’t know if he left but unlikely	Recovering but compulsive gambler – marriage frequently rocky.
James Bellamy (9)	Strongly supportive of his ‘ma’ rowed with matt recently	Yes	Not in ambridge as far as we know?	Shady
Adam Macy (10)	Has been embedded in Lilian/matt/Justin lovetriangle throughout. Had fist fight with Matt in response to homophobic slurs, lied about his incident to Iain	Yes to both	Was driving his and Iain’s car home from the ball at the time...	History of infidelities and has got tied in knots covering these up. Very mixed feelings about having children with Iain. Covering over assault of Matt as lied to Iain
Iain Craig (11)	Had inexplicably weighed in to insult Lilian for her ongoing interest in Matt – touchy after Adam/Charlie flirtation almost ended his marriage	Was going to get a taxi home at the end of his shift – Adam had his car	NO As caterer of the Ball at Grey Gables would not have left until after survivor’s breakfast	Was manipulated by Rob but generally quite straight-shooter.