Nature of legal evidence

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Introduction

Redmayne (2001) argues that a criminal case, a case being a series of interlinking series of arguements commonly used to convince a jury that an individual may be guilty of a crime, is not a natural, or given type which is the consequence of investigation, but is a construct tailored for the purpose of convincing a jury of a suspect's guilt. In the course of an investigation into a reported criminal offense there may be many different strands of information availible to the investigator, a few of which will lead the investigator to resolve that a specific individual was responsible for a criminal act. Some of the overall collected information will go on to make up the case to be presented in a court of law, much of the information will not. Those pieces of information selected to be presented in court are not necessarily the same as those which actually convinced investigators that a particular individual was worthy of further investigation, and sometimes because those pieces of evidence which are eventually employed in court are not available until a suspect has been the subject of closer scrutiny, because small indications and elements of perception which may convince an investigator a suspect is the offender would simply not convince an impartial fresh jury, fresh to the subject matter, of the case.

Take for example the investigation surrounding the dissapearence of Holly Wells and Jessica Chapman in August 2002. Stephenson & Williamson (2005) report that officers who first interviewed Ian Huntley, who eventually turned out to be the offender, said "He may just have had an unfortunate manner, but neither myself nor PC Bradley were

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happy with him". Later, during the course of the investigation, Huntley asked a Special Constable a number of questions which that constable considered suspicious. These questions included "Have they found the girls' clothes?" and "How many miles out will they search?". During a search of Soham School Huntley was described as being "overly helpful". It was these small indications which led to a search of Huntley's house, and to a set of keys to an area of Soham School which contained a bin in which the burned remains of some of the two girls clothes lay. Eventually 7532 exhibits were recovered from 11 locations, and a strong case was made against Huntley

Those small indications, based on individual officers intuition, were enough to warrent the further investigations which then provided the evidence used in court to convict Huntley. The indications may have been mentioned at the trial, but were not the mainstay of the evidence against Huntley. The case against Huntley was constructed from evidence in a *post*-investigation phase and comprised elements of evidence which seemed most convincing to a neutral audience.

This demonstrates quite well some of the difficulties faced by evidence scholors. Much of the thought on epistomology stems from phillosophers' need to represent sense-data and observation apparent to the individual mind on a logical basis to produce a theory of empiricism without the weaknesses involved in fully coherence based notions, nor unwarrented assumptions about the logical nature of causal relationships between observation and belief (Haack; 1993). However, evidence in criminal law is not exclusively about whether a single mind can have any claims to holding an opinion justified or not. It is about whether, in a very public arena, several neutral minds are persuaded of, or against, a narrow set of claims about the behaviour of an individual, or individuals, and that alleged behaviour in respect of law. Evasive answers, shifty eyes and a past criminal record may be enough to convince some of an individuals guilt of some offence, but a criminal trial necessitates a collective decision by, at least in United Kingdom jursidictions, twelve people.

Is it the case that to convince twelve people of a defendents guilt, or innocence, on a single occasion is a different epistomological matter than convincing twelve people of guilt or innocence singly? Or should rational minds be so similar that, in principle, exactly the same evidence will have exactly the same effect on each of the twelve, and that a jury collective be regarded as a single mind? And what of evidence itself? In much of the literature on evidence, evidence is seen as some sort of given entity. The structure of evidence is seldom, if ever explored, most authors choosing instead to examine the effect of evidence, who is qualified to give evidence and how evidence is used in criminal courts. This paper sets out to explore in some detail some of the ways in which evidence is constructed, and how it can be seen to differ from simple observation and information.

Evidence

Occasionally one hears that "the police are searching for evidence", or that a police station, or forensic science laboratory has an "evidence room". From this common useage one might deduce that evidence is a collection of things which can be used in a court to press criminal convictions against. In a sense this is true, the articles found in an evidence room are indeed evidence, and the police will search for "items of evidence" at a crime scene. But does this notion of evidence encompass what evidence actually is?

An eyewitness, or expert, can present evidence to a court. Clearly an eyewitness does not always bring a physical object of any description for the inspection of the court and neither does the expert witness. The evidence an eyewitness has to give to a court is that of a description of events, or individuals associated with some offence. The expert witness may base their evidence on the inspection of objects from a police evidence room, but the evidence itself will be the information that the expert witness has to impart about their inspection. So is evidence a particular set of observations which can be used in

court, and if so, what makes a piece of evidence distinct from a raw observation?

The answer must to some extent involve the idea that evidence pertains to a particular proposition, or propositions. That is, what distingushes evidence from observation is that evidence is inextricably bound up with the context in which observations are used. Usually, in the context of evidence in the Common Law, it is seen to support, or refute, a particular proposition or set of propositions, which either directly, or indirectly, lend support, or undermine, one or another of the sides arguements in a case.

It is clear that the distinction between observation and evidence is that evidence requires some form of proposition, or in a legal context propositions, to place observations into context. However, because propositions differ, and the same observation can have some sort of relationship with at least two differing propositions, it is obvious that some sort of intermediate level theoretical statement must act as an invarient relationship between observation and any set of propositions which may be considered in relationship to the observations in question. This intermediate level can be a scientifically held idea of how a given set of observations could have been made, or, a table of empirical data. The important feature of this intermediate theoretical level is that it must be a description of the relationship between a set of observations and set of propositions.

For example, let us imagine that a crime has been committed, and that a suspect has been detained. The suspect denies ever having been at the location of the crime, but a shred of fabric indistingushable from the fabric used to make a type of clothing possessed by the suspect has been recovered from the crimescene. A suitable set of propositions to which the observed indistingushability between the crimescene fabric and that from the suspect can relate are at the level of an empirical fact from Hohfeld 1923, or a source level from Cook *et al.* (1998), and are: *the proximal source of the fabric recovered from the crimescene was the suspect*, and, *the proximal source of the fabric recovered from the crimescene was not those items of clothing belonging to the suspect*. An intermediate

theoretical level might encompass ideas as to whether the crimescene fabric really is indistingushable from that fabric from which the suspect's clothing is made, and, how many other potiential sources of indistingushable fabric there are. These constitute the background information of a fabric expert, and are based upon experience gained from past observations of fabrics, and relate the observation of indistingushability to the propositions for the source of the fabric.

The evidence in this case is not an undiluted observation, but a convolution of the observation, a theory of indistingushablility, and expert knowledge based upon other observations of similar and dissimilar fabrics. In other words evidence is an observation and a set of relationships between it, and a set of propositions, and can be considered a form of arguement which sheds some light onto a limited number of aspects of the world.

Generally propositions must be contradictory, either partially contradictory, or for the greatest parsimony, wholly contradictory, in relation to the case. Were any set of propositions to consist of materially the same proposition then there would be only a single proposition. If the propositions were only partially contradictory then there would be clauses which would be safely eliminated from each proposition without affecting any percieved value of that evidence. In the example above the propositions could be *the proximal source of the fabric was the trousers from a suit belonging to the suspect*, and, *the proximal source of the fabric was the jacket of the suit belonging to the suspect*. These propositions, although contradictory, are not contradictory in respect of the ultimate issue which the court is trying to decide as the suit belongs to the suspect. Were the jacket and trousers of the suit made from the same fabric as each other then the simple empirical fact of indistingushability would not be evidence for, or against, either of the two propositions. Of course it might be that the most pertinant intermediate theory would require common elements between propositions. Were the observation of the fabric that of matching the tear patterns from the crimescene fabric to either the jacket or the trousers of the suit, then a suitable intermediate theory might be from experience of

the particular fabric type. In which case the observation could be regarded as evidence in the debate as to whether the crimescene fabric came from the jacket, or trousers of the suit belonging to the suspect.

This brings us to the interesting, and interlinked epistomological points of whether evidence can be said to be complete without at least two propositions, and whether there is a need to address all propositions associated with evidence? XXXX

In the toy example above the observation of indistingushability could not support, or refute, propositions about the ultimate issue, or constitutive fact, of the suspects guilt or innocence. There is no reason in principle why the evidence should not be restructured so that propositions were at Cook *et al's.* activity, or even offence levels. However, the information which related the observation of the fabric would have to be changed to address the new higher level propositions, and would not necessarily be availible to the expert. A single piece of evidence will only support, or refute, a relatively narrow range of propositions which are bounded by the observation, and the supporting information. Therefore the same observation can relate to a large range of propositions, but only by changing the network of supporting theory and observations. Any evidence used to address other propositions required some form of inductive leap which would be unsupported empirically. Above the evidence that the fabric found at the crimescene came in some proximal sense from the clothing of the suspect may be extremely convincing, but to arrive at the conclusion "the suspect was the offender" would require an inductive leap on the part of those hearing the evidence. The sort of "added" information which would be required to turn evidence for the source of the fabric at the crimescene into evidence for the constitutive fact of the criminal offence would revolve around the likelihood of those committing a criminal offence leaving behind fabric traces, and, the likelihood of the suspect wearing the specific clothes were that suspect intending to commit an offence. These sort of data would usually be unavailable to a court, and would not be the subject of current external expertise, so some form of inductive leap, induced from the day to

day experience of those hearing the evidence, would have to be made.

A Mode for Evidence

In the previous section an arguement was made for a fairly narrow conception of evidence which would distingush evidence from observation. Here we attempt to explore the mechanics of how evidence can work, and whether there are any standard types for evidence.

Whenever one imagines some observation type, such as a DNA profile, or similar observation, what sort of background theory are we suggesting which makes the connection between the observation and relevant proposition? Is it one of *this profile matches the suspect, this profile matches the suspect and only the suspect, therefore the source of the profile is the suspect?*. In the case of a DNA profile we do not know the second statement to be true. The background theory of DNA profiles suggests that for any of the systems used by forensic scientists there will, from a sample of 2 million or so people, be a couple of individuals who share the profile. The same is true of other sources of observations. If it is known an offender has a limp and a tattoo on his left hand, and a suspect has a tattoo on their left hand, and a limp, then from a large sample of individuals one might be surprised were there no other instances of a person with a limp and tattoo on their left hand.

Even were the name of an offender known, and a suspect of the same name presented before a court, it is by no means guarranteed that the suspect the posession of an identical name means with any necessity the suspect is the offender. A quick examination of any telephone book will reveal that name frequencies range from none, to several hundred individuals who share a name.

So how can some property, for convienience denoted by the Greek symbol ϕ, such as a DNA profile, limp, or name, ever come to be regarded as an observation which is ger-

maine to establishing a case against a defendent? The answer is that ϕ does not indicate the defendent, and only the defendent, but that ϕ effectively eliminates those persons who do not possess ϕ. In essence the way in which evidence in criminal proceedings works is in some eliminative/deductive way which excludes all but a very small subset of population P from suspicion. Obviously this process necessitates a definition of of some sort of population P, and suggests that any meaning given to the observation of ϕ must be in a context of P.

The way in which observations can be thought to relate to propositions through a process of eliminative deduction applies to evidence which may not be thought of a scientific. Take the testimony of an eyewitness. The witness may have been present at the commission of a crime, and can identify a suspect as an offender through direct recognition. However, direct recognition can be thought of as the observation of a series of properties which are shared between offender, and suspect, such that when the witness encounters the suspect a "gestault" of recognition is triggered in the mind of the witness. Thought of in this way eyewitness evidence can be regarded as eliminating from suspician all those persons who do not trigger recognition, and has exactly the same claims to knowledge of the offender suspect relationship as a DNA profile, or other shared trait. This is not to suggest that the "gestalt" of recognition works by the elimination of possibilities until only one remains, and when that happens the mental phenomina of recognition results, but that this is one way in which recognition can be rationalised and put on an equivalent mechanistic basis with other observation types.

It is the notion that the underlying logic of evidence describes a relationship between observation and proposition which eliminates possibilities which have no correspondance in events which, by ennumeration of the propostion of eliminated possibilities, allow us to make some form of quantitive estimate of a "value of evidence" in respect of a pre-defined proposition, or set of propositions. Generally the more possibilities evidence eliminates, the greater the "value" of that evidence in supporting, or refuting, those propositions to

which that evidence relates.

Evidential Tropes

The eliminative conception of legal evidence allows relatively easy evaluation of that evidence by the assessment of the quantity of eliminated possibilities. But can we use the notion of elimination to construct some tropic forms for legal evidence, and the ways in which different forms of evidence relate observations to propositions?

As above, let us define an irreducable evidential fact ϕ in criminal law to be akin to a raw observation. An observation in scientific endevour might run along the lines that an object viewed in a specified light appears blue, or that the output from some sensor is $52mV$ for a given set of machine inputs. An irreducable evidential fact is one which may be, but not necessarily, at a higher level than a scientific observation, but is the level which is lowest for the fact to still have meaning in an evidential sense. Such a fact might be that the DNA from a specified number of alleles recovered from a crimescene shows no differences in respect of those same alleles to a DNA profile extracted from a suspect. The actual observations in this case would be lists of alleles. It takes a further stage of inference, based on some intermediate theory, to say that "there are no differences". The irreducable evidential fact is that the alleles recovered from the crimescene are the same as those recovered from the suspect, or to put it in terms a forensic scientist, or lawyer would understand, that there is a "match between" the DNA recovered from the crimescene, and the DNA of the suspect.

Other irreducable evidential facts might be that an offender wore a brown pullover during the commission of a crime, the suspect posesses a brown pullover, so there is a match between the offender's brown pullover and the suspect's brown pullover. A eyewitness describes an offender as male and white, of medium height and build, a suspect may

be male and white of medium height and build, and when presented to the eyewitness the witness says "it is he!". The irreducable evidential fact here is that the suspect is a "match" for the offender in respect of the properties of height and build and all those other properties which cause recognition on the part of the witness.

If a criminal offence has been committed, then there must be a series of entities which have been associated with offences which belonging to the same legal category: denote this C. If a specific criminal offence has taken place there must also be an entity, or set of entities, which are directly linked to the particular instance of offending. Call this o, it is the case that $o \in C$ and $n(o)$ is usually small or very small.

Likewise, if there is evidence then there must be an entity, or set of entities, possessing attribute ϕ corresponding to the irreducable evidential fact; denote this set Φ. If there is a suspect, denoted by s, and s posesses ϕ it must be the case that $s \in \Phi$.

Finally, as defines above, there must also be a population of all entities posessing all attributes. Call this P, so that $C \in P$ and $\Phi \in P$. Obviously $n(P) \geq n(C) + n(\Phi)$. This can be depicted as a Venn diagram (Figure 1).

Figure 1: Venn diagram depicting population P, set of all entities associated with offenders c, and set of entities Φ which possess trait ϕ. We know o is a member of C which is the set of persons who commit offences of the same class as the one under investigation.
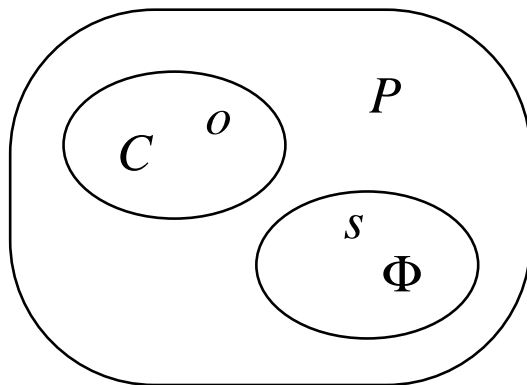
By rearrangement of the entities refered to in Figure 1 we can to some degree explain how different observation and proposition types commonly used in criminal cases form different arguements by examining the process of elimination and set of relations between o, s, C and Φ.

Matching Problems

Many instances of evidence are where offender o shares some characteristic ϕ with suspect c. The evidence gains it's strength through the relative rareness of the characteristic ϕ in the population P, and commonness amongst those thought to have perpetrated the offense.

An example is where DNA might be extracted from a crimescene, it is thought the profile was from an individual linked to the offense. A suspect is rounded up, a profile taken, and there are no differences between the suspect's profile and the profile recovered from the crimescene.

Here we know that the true offender o is a member of the set Φ, and that the suspect s is

also a member of the set Φ because both possess DNA profile ϕ. This can be visualised by the Venn diagram Figure 2.

Figure 2: Venn diagram depicting matching problem. The shaded area represents that area of the information space where the true offender is known to reside, the double-headed arrow by suspect s indicates that there is some uncertainty about where s should be.
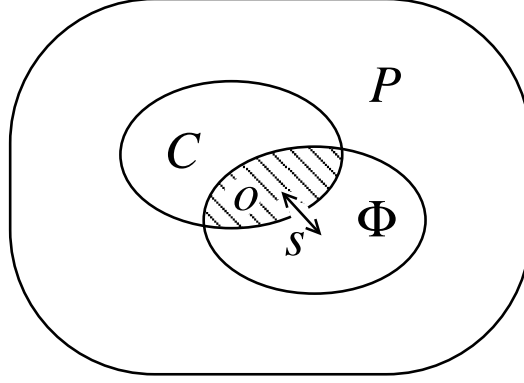
In Figure 2 we know by definition $o \in C$, and by observation and inference $o \in \Phi$, therefore $o \in C \cap \Phi$. Suspect $s \in \Phi$ by observation.

To evaluate the presence of trait ϕ we could use the likelihood ratio:

$$\mathrm{LR} = \frac{\Pr(s \in \Phi, o \in \Phi | s = o)}{\Pr(s \in \Phi, o \in \Phi | s \neq o)}$$

$$= \frac{\dfrac{n(\Phi)}{n(P)}}{\dfrac{n(\Phi)}{n(P)} \times \dfrac{n(\Phi)}{n(P)}}$$

$$= \frac{n(P)}{n(\Phi)} \tag{1}$$

Equation 1 is a perfectly standard expression for a likelihood ratio for a matching type problem, and is essentially the reciprical of the populational frequency of trait ϕ.

The elements s and o refer to the observables, thus would be DNA profiles, or glass fragments, or whatever was observed, so the propositions $s = o$ and $s \neq o$ refer to the source level. The element o has been confined by the observation of ϕ to $C \cap \Phi$, however as we really cannot know too much about whether o is a new member of c or not our knowledge that $o \in C \cap \Phi$ is of limited use. The best we can say is that $o \in \Phi$ and $C \in \Phi$, and evaluate the observation of ϕ on this basis.

Solutions to matching problems generally make statements at a source level of proposition. They require a precise specification of an offence and most critically require something to be known about the offender, that is the offender posesses trait ϕ. For matching problems the logic of the arguement can be summerised as a syllogism: the offender has ϕ, the suspect has ϕ, some others besides the suspect have ϕ, therefore the suspect is one of those who could be the offender.

Class Problems

A different type of arguement used as criminal evidence is what I have termed here a "class matching" problem. This is where the offence is specified at the level of activity and behaviour. Such propositions as "the suspect has been involved in murdering patients", or more pertinantly, "the suspect has at some stage become embroiled in drug trafficking". The empirical evidence then has to show whether an offense has been committed. If the evidential facts can show an offense has been committed then the suspect is the offender.

An example may be where a suspect is detained for child murder. A component of the evidence is that the suspect has had two children die whilst in their care, in this case the irreducable evidential fact is $\phi = $ deaths of two children. In this case there is a proportion of the population P who have truely murdered children (C), and who have managed to murder two children $(C \cap \Phi)$. There is a proportion of the population who have not murdered children, but nonetheless have had two children in their care die, thus are also

designated as belonging to set Φ.

The position may be summerised in the following Venn diagram (Figure 3). The arrow in Figure 3 indicated that we are uncertain as to whether s is a member of $C \cap \Phi$.

Figure 3: Venn diagram depicting class problem. The shaded area represents where it is known the true offender resides. The double-headed arrows by both o and s represent uncertainty about their true positions.
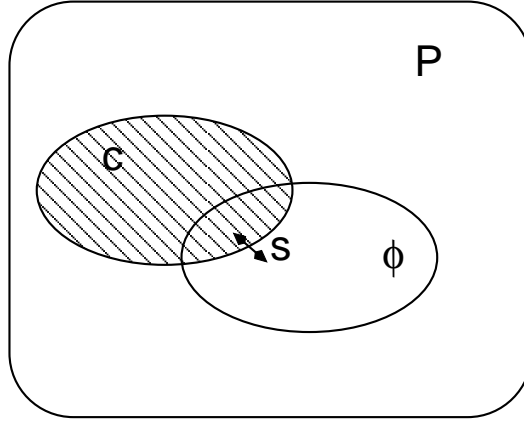
To evaluate the evidence of observing ϕ we could assess the likelihood ratio:

$$
\frac{\Pr(s \in \Phi | s \in C)}{\Pr(s \in \Phi | s \bar{\in} C)} = \frac{\dfrac{n(C \cap \Phi)}{n(C)}}{\dfrac{n(\Phi) - n(C \cap \Phi)}{n(P) - n(c)}}
$$

$$
= \frac{n(C \cap \Phi)\left[n(P) - n(C)\right]}{n(C)\left[n(\Phi) - n(C \cap \Phi)\right]}
$$

$$
= \frac{n(P)n(C \cap \Phi) - n(C)n(C \cap \Phi)}{n(C)n(\Phi) - n(C)n(C \cap \Phi)} \tag{2}
$$

To assess this it would be nice to know the number of child murderers $n(C)$ from P, and the proportion of those who had murdered two children ($n(C \cap \Phi)$). In principle these should be no more difficult to find than the frequency of ϕ from any population P, so the expression should be evaluable, if a little trickier in practice than for the matching

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problem.

Discussion and Conclusions

The structure of the sort of evidence used in criminal proceedings is bipartide in that it has observation, the empirical part, a set of intermediate theories which link the observations to a predefined set of propositions. The intermediate theory can be a scientific theory, or another set of empirical observations which involve the propositions and observations. Propositions for their part must be selected so that they are at least partially contradictory.

Examination of this structure has revealed that there are at least two ways in which evidence can be structured: as a direct matching problem, or, as a class matching problem. The first is where a property of a suspect is known to be shared with the offender. The observation is that of "matching" properties, and intermediate level of information might be the frequency of the property amongst the general population, and related theories of observation. Propositions, in a forensic context, would usually be restricted to those of the observed match, or *source* level propositions, and constitutes a metonymy whereby the observation of ϕ is substituted for the offender, and suspect.

The second way we have found evidence to be structured is as a class matching problem. This is where the observation is of a particular property not associated with any particular offender, from any specific offense, but a property associated with a class of offenders who have committed, in law, different instances of the same offence. The synecdocheical aspect of this form of evidence is that the class Φ is being employed to stand in for both offender and suspect. The intermediate level of information would still involve theories of observation, but might include relative frequencies of the property in question amongst offenders and the population as a whole. The propositions for this structure of evidence

would concern the membership of any suspect to the offender group, and would necessarity imply that the propositions were framed at the *activity* level.

The usual mode for forensic evidence, and in particular scientific evidence, is the direct matching mode, or metonmical mode. Here we have to know something of the particular offender, namely the offender can be described as being of property ϕ. Evidence types which may follow this mode of reasoning are:

1. DNA matching problems where a profile is recovered from a crimescene and the profile is indistingushable from the profile of a suspect. Here the set Φ may be very small in relation to P which gives a high level of exclusion to non-ϕ bearers.

2. Fibre matching where fibres recovered from a car seat and are connected with an offense are indistingushable from those recovered from the clothing belonging to a suspect.

3. Glass where glass recovered from a crimescene and thought to be linked to an offense and glass fragments recovered from the clothing of a suspect.

4. Direct eyewitness statement. A person saying I saw the offense, and saying "It were he!" is using a set of characteristics ϕ which that witness has observed, and which produces the feeling of recognition in them. In this respect there is no difference between this sort of evidence and any other sort of matching type problem except $n(\Phi)$ is usually unevaluated in day to day casework. Direct eyewitness evidence also allows propositions to be formulated at an activity level.

The class matching, or synecdochical, mode of evidence often appears as evidence of motive, although it can also be presented as scientific. Evidence of motive simply suggests that a member of the class of motive holders (Φ) is more likely to be a member of the set of offenders than non-Φ members. There is no documented instance known to the authors where this has been evaluated. Synecdoche is also the mode of evidence described in Davis & Follette (2002) as *intuitive profilling* where "the party/defendent in

question *has the characteristics* of a person likely to engauge in the behaviour at issue". Davis & Follette (2002) say that, at least in the courts of the United States, this type of evidence is introduced without supporting base rates. They argue very strongly for the presentation of these base rates whenever this type of evidence is presented in court.

An example of this type of class based problem being presented as scientific evidence is where a suspect thought to have been connnected with the supply of controlled substances has been detained. No controlled substances were located, either on the suspect, or at premisis connected with the suspect, however, a considerable amount of paper money has been recovered in connection with the suspect. The paper money has been subject to a chemical analysis, and has been found to have unusually high levels of contamination of some illicit drug. The arguement in this case suggests that those who supply controlled substances are more likely to have highly contaminated banknotes than those who do not, the suspect has highly contaminated banknotes, hence the suspect is a member of a set of individuals who supply, or are connected with supplying, controlled substances.

Some instances of evidence which are in this category are:

1. A piece of material, the composition of which suggested it was fired gun shot residue were recovered from the pockets of a coat belonging to Barry George, then a suspect for the murder of Jill Dando in London during 1999. George was subsequently tried and convicted for this murder. Here this evidence can only relate George to a set of individuals who have committed firearms offences, and not the specific instance of the shooting of Jill Dando.

2. Part of the evidence brought against the men convicted of the Birmigham pub bombings comprised a set of chemical analysis from swabs taken from their hands showing they had handled explosives. Later this found to be from a new pack of playing cards. Notwithstanding that the swab demonstrated they had been handling explosives and that they belonged to a set of people who had previously

been using explosives - not a direct link to the Birmingham pub bombings ta all, merely to a set of people who had come into contact with explosives.q

3. Sally Clark's two sons died whilst in her care. The evidence was the death of two children which was compared (in an incorrect way) to the loss of two children in the wider population.

4. Janis Gabriel, 49, from Padiham, Lancashire, was convicted on two counts of possession of criminal property. Her council house was described as a palace with jacuzzi, four-poster water bed, swimming pool, fitted kitchen, conservatory and 42-inch plasma TV. The court heard Gabriel received £2,000 a month in benefits for her seven children and disabled husband John. She is accused of funding the family's lifestyle through the proceeds of criminal activity. But when police raided her home in 2003 they found £18,000 in £20 notes and bank accounts with thousands more[‡]. Here ϕ is the shear level of wealth accumulated by Gabriel, and C the set of fraudsters. We could go further as the defence hypothesis is that the money was won at bingo, so we could define a new group as b bingo players, and examine the ratio of $n(C \cap \Phi)$ to $n(C \cap b)$[§].

The list above includes many miscarrages of justice which have been supported through by this sort of evidence.

A factor which disguises the underlying similarity in the instances of evidence which make up a "class" matching type of problem is the way in which they're mishandled from the scientific point of view. Where drugs are found on banknotes one should use samples of notes from known drug dealers, and samples of notes from those known not to be drug dealers. It is common practice simply to compare the levels from a suspect sample of notes to background, and omit the known drug dealing sample. This is of course a dreadful mistake, although easy to rectify in practice. In the Barry George case

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[‡]See: http://news.bbc.co.uk/2/hi/uk_news/england/lancashire/3962259.stm

[§]This needs a bit more thinking about

no sample of those known to have killed through use of a firearm were inspected for particulate Barium, and no sample of those who had not used a firearm was inspected. In effect nothing about particulate Barium was known at all in the scientific sence. This is, needless to to say, a blunder of the highest order on the part of the prosecutors. The same inspired lack of scientific knowledge gave us the embarrising case of the Birmingham six, where a large part of the scientific evidence was the swabs taken from the mens hands. It wasn't until Brian Caddy came along and demonstrated that the same results would have been observed from the handling of playing cards that it was realised that the same observations could have been made about anyone partial to playing cards in order to while away the hours on a long train journey, and that the observation didn't necessarily put the men into the guilty category. In the case of Sally Clark we at least saw the evidence of two dead children being compared to a background population, albeit one of the worst analyses of the modern era. The sample of known child murderers would be difficult to find to make any comparison. For Janis Gabriel the probability of winning so much money through bingo related activities could in principle be established, but it is quite difficult to imagine a set of fraudsters willing to own up to playing bingo.

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