Investigative sense-making in criminal contexts

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Investigative sense-making in criminal contexts

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ABSTRACT

In this paper we discuss three crime contexts in which expert investigators undertake sense-making, a critical component of decision-making expertise. The first context, initial assessment in criminal investigations, illustrates the process of explanation-building. We present preliminary results showing how salient cues elicit legally-defined scripts that guide detectives' interpretation of data. The second context, hostage/barricade scenarios, illustrates the dynamic and interactive nature of sense-making. In this context, negotiators show evidence of using cognitive frames to simplify the task of making sense of complex, fast-paced dialogue. They also adhere to learned scripts about the development of relational and substantive aspects of the negotiation. The third context, insurance fraud, illustrates how investigators develop and test hypotheses within a framework of anticipated deception. We suggest that scripted explanation, anticipated deception and dynamic adaptation may be common aspects of expertise across different investigative domains.

KEYWORDS

Sense-making, situation awareness, police investigation, explanation building, insurance fraud, hypothesis testing, deductive inference, framework of innocence, hostage negotiation, cognitive framing, phase models.

INTRODUCTION

A critical, though as yet poorly understood, aspect of expertise in criminal investigation is the set of knowledge and skills associated with 'sense-making', whereby an investigator uses available information to construct an understanding of a 'to-be-investigated' or ongoing incident. Criminal investigators are often faced with the task of making sense of a large amount of ambiguous and complex data, with a view to establishing which of the various plausible alternative explanations is likely to be the truth. Sense-making is of central importance to identifying appropriate and promising lines of enquiry. Inappropriate lines of enquiry can hamper investigations, at best wasting time and resources and at worst proving fatal to the chances of resolving the case successfully.

Our interests in sense-making are discussed here with reference to three different but related domains of criminal enquiry: understanding crime reports and scenes, monitoring and decision-making during ongoing hostage–taking and barricade incidents, and following up suspicious insurance claims to evaluate whether fraud has been committed. Despite differences in the scope and complexity of their respective investigative problems, police officers, negotiators and insurance investigators face similar challenges in sense-making. In each of these contexts, the professional investigator has to deal with a large set of domain attributes that make sense-making a difficult enterprise. These include:

- complexity (e.g., there may be large amounts of potential evidence and many witnesses and/or perpetrators);

- incomplete data (e.g., in a hostage situation, attending officers have limited channels of communication that are controlled by the hostage takers);

- ambiguity (e.g., the same piece of information, such as bruising on a child, can be interpreted in more than one way, accidental or inflicted deliberately by an assailant);

- risk (e.g., the failure to identify a claim as fraudulent may expose an insurance company to further claims once a route to fraud is established).

These features are by no means exhaustive, and nor do they, in themselves, distinguish investigative contexts from other domains of expertise. For example, process control domains such as the nuclear industry present similar challenges (Roth, Lin, Kerch, Kenney & Sugibayashi, 2001; Ormerod & Shepherd, 2004): a fault in a heat exchanger will cause widespread perturbations across a plant (complexity), potentially knocking out alarms and indicators or conversely bombarding the operator with too much information (both leading to incomplete data), the nature of heat exchange may

reveal symptoms and warnings some distance from the site of the fault (ambiguity), and faults must be diagnosed and fixed under pressure of serious consequences (risk).

However, there are three challenges faced by criminal investigators that we suggest are in some respects different to those faced by operators in domains studied hitherto in NDM research. First, although there are archetypical crime scenes, modus operandi and clues, the range of scenarios that a criminal investigator might be faced with is, in principle, infinite. Moreover, what evidence there is may point to more than one possible explanation. Thus, a fundamental component of investigative expertise is explanation-building. Pennington & Hastie (1988) have shown how inexperienced jurors are guided by the presentation of evidence to create narrative explanations that subsequently determine their judgments. In the case of expert-led investigation, explanation-building through narrative construction plays a similar role, but tends to be guided as much by internal knowledge structures as by external evidence. As we illustrate below, explanation-building relies on stereotypical scripts that emerge both from personal experience and also from structures, particularly legal scripts, which pertain to the specific domain of investigation. However, explanation-building also appears to involve going beyond the available evidence to construct speculative narratives that can provide missing components such as motives, potential evidence trails, and so on. Moreover, in contrast to Pennington & Hastie's novices, the expert investigators we studied used explanation building to search for alternative hypotheses rather than as a device for reifying a single account.

Second, at the heart of criminal investigation is the need to make sense of human action, reaction and interaction (as opposed to, say, the abnormal operation of aircraft, likely paths of missiles or spread of fires). An investigator must deploy a sophisticated understanding of the behaviors of many types of individual and groups (e.g., suspects, offenders, victims and witnesses). As Alison and Barrett (2004) point out, this "requires both a deep and a broad understanding of the properties of social systems that are inherently complex and unpredictable" (p.68). We suggest that expert investigators are able to accomplish this feat by calling upon internalized cognitive frames that allow them to generate expectations about the actions and responses of others in real time.

Third, in criminal investigations, unlike most other diagnostic contexts, one is likely to be working in an environment where there is intent to deceive. The deceptive characteristic of criminal contexts necessarily requires expertise that goes beyond straightforward situation assessment: at very least there is a need for both evidence-based (the 'given') and inferential (the 'hidden') variants of situation assessment. We propose that expert investigators are adept at reasoning in the face of deception, and are able to turn in to their advantage. For example, in the context of insurance fraud investigation, we describe empirical evidence that suggests investigators deliberately adopt a framework of innocence, a cognitive frame that enables them to construct powerful tests of suspicious contexts.

Sense-making is most closely related to the NDM concepts of situation awareness and assessment (e.g, Endsley, 1995, 1997; Klein, 1989, 1993). For example, Endsley (1988) defines situation awareness as "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future" (p. 97). Features of seeing, understanding and prediction are common facets to any domain in which an expert encounters an incident or situation. Klein's (1989) recognition-primed decision theory of expert judgment presents an account of expertise that is based on situation awareness: recognizing a situation as appropriate for a particular course of action triggers an appropriate rule-based response decision.

Although sense-making and situation awareness are related, we suggest that they are not precisely the same thing. In fact, situation awareness may be thought of as a subset of sense-making, in which presented situations are such that experts are able to reach rapid perceptually-based assessments. Sense-making also includes complex and novel scenes that may never have been encountered but where experts can nonetheless bring to bear their knowledge and skills to make sense of a situation or incident in ways that a novice cannot. For example, Feltovich, Spiro, & Coulson (1997) describe how highly skilled medical diagnosticians are able to go beyond obvious but incorrect diagnoses reached by less skilled physicians to develop sophisticated accounts of rare symptom sets.

The three factors described above that make criminal investigations different from other expertise contexts also, we propose, make sense-making in these contexts different from situation assessment. Given an infinite range of possible scenarios and a high likelihood that there will be few if any immediately recognizable perceptual cues that can trigger an appropriate rule-based response requires the investigator to create a potentially novel response in real time. Also, the fact that investigators are focusing upon understanding human action and reaction rather than the state or responses of physical processes or plant, which introduces additional layers of complexity and unpredictability. Moreover, the deceptive nature of investigative domains means that what is seen first is unlikely to be a true picture of the underlying structure of a scenario. As a consequence, a rule-based response to an immediate and perceptually-based judgment is unlikely to prove the most beneficial course of action in every case. Indeed, anecdotally at least, a feature that distinguishes successful from less successful investigators is an ability to hold back from making immediate judgments about likely causes, motives and perpetrators. Early commitment to a specific hypothesis can shut off potentially useful lines of enquiry and lead investigators down blind alleys.

In the remainder of this paper, we discuss three studies in which police and insurance claims investigators undertake real decision-making activities. The paper provides an exemplar of applying an NDM approach to understanding expertise in criminal investigations, and highlights commonalities and differences in expert investigators' approaches to sense-making.

SENSE-MAKING IN A 'TO-BE-INVESTIGATED SITUATION'

In criminal investigations, the initial assessment of a to-be-investigated (TBI) situation can sometimes have a profound influence on the course of an enquiry, as the classification of situation as a particular type of crime (or non-crime) may lead officers to follow worthless lines of enquiry or to close off potentially fruitful lines of investigation. The classification of an event as a particular type of crime may also limit the resources that a force devotes to the investigation, which will also have an important impact on the likelihood of a successful resolution. However, the assessment of a TBI event is far from straightforward: the information available at the start of a criminal investigation is often complex, ambiguous and contradictory, and thus subject to multiple interpretations and multiple potential classifications. As such, a simple perceptually-based model of situation awareness is unlikely to capture fully the expertise required for sense-making in these contexts.

Elsewhere (Barrett, 2002), it has been suggested that detectives seek to build hypothetical investigative situation models (cf. Graesser, Mills and Zwaan, 1997; Endsley, 1995, 2000). These are mental models of particular situations, as opposed to mental representations of general states of affairs based on stored domain and general knowledge. So, for instance, a detective may have generic mental representations of what occurs in the crime of rape. When faced with a TBI incident that may or may not be a rape, he or she must develop one or more plausible mental representations of that specific situation. Generic mental models provide a framework for the construction of situation models, but can also be used to detect anomalies in constructed situation models, a process which may trigger a search for additional data to resolve the anomalies, or prompt the rejection of a situation model.

The suggestion that detectives draw on generic mental models to make sense of TBI incidents raises two issues: the general form of mental models in investigative settings, and the factors that influence the selection of a particular model or model(s) as appropriate in a particular setting. Klein and his colleagues, in their Data/Frame theory of sense making (Klein, Phillips, Rall and Paluso, 2003) argue that sense-making is an active, bidirectional (top-down/bottom-up) process. Individuals respond to ambiguous or anomalous information by seeking an explanation for it, but the repertoire of generic mental models (or, as Klein et al. term them, frames) influences both the data attended to, and the interpretation put on that data. In the investigative context, Klein et al.'s theory is supported by Innes (2003), who, in his qualitative study of UK homicide investigations, describes how officers identify and decode particular 'signs of crime' in investigative information (p.178). These 'investigative signifiers' are the crucial elements of a TBI situation which enable the detective to label it as being of a particular type. This categorisation of a TBI situation supports the detective by providing a framework that serves to explain the elements within the situation, to highlight deviations from the expected framework, and to guide investigative action.

The operator's goal in a particular situation will also, crucially, influence the set of frames which is likely to be activated. In criminal investigations, the detective's task is to make sense of that situation in relation to a specific goal: to determine whether or not a crime has been committed and if so, what crime, and by whom. More precisely, enough evidence must be gathered to convince a jury that the defendant is guilty according to the terms of a precisely worded legal charge. It is likely, therefore, that investigative sense-making by police officers is guided by legally determined scripts, and that the most salient cues will be those relating to the nature of the crime committed (if any) and the identity of the offender. The goal of criminal investigation limits the set of scripts which it is necessary for a detective to apply in a TBI situation to those that are legally determined, and this in turn influences what data will be attended to in that TBI situation.

In an exploratory study (Barrett and Alison, submitted), the aim of which was to begin to understand the process by which detectives construct an understanding of potential crime in the early stages of an investigation, 44 detectives from a British police force gave written interpretations of crime-related vignettes, similar to reports received by detectives at the beginning of an investigation and of varying ambiguity. Answers were content analyzed to determine participants' hypotheses about what had occurred in the vignettes and to examine what cues they attended to.

In one scenario, a concerned grandmother called the police to report that whilst bathing her four-year-old grandson she had noticed marks on his skin, which she likened to those made by a stick. She also volunteered the information that her daughter in law (her grandson's mother) had recently started a relationship with a man who had convictions for assault. In all, 88% of participants agreed that the most likely explanation of what had occurred in this case was that the child had been abused, and 65% suggested that the boyfriend had been responsible for this abuse. The cues mentioned most frequently, and which, therefore might be considered to be particularly salient, were those relating to the nature of the injuries to the child, and whether or not they had been deliberately inflicted. If this scenario were to be investigated as a child abuse case, the prosecution in any subsequent court case would have to prove that the child's injuries were non-accidental. Information concerning a plausible suspect - the mother's new boyfriend - was also salient for many

participants. This man's violent tendencies, as evidenced by his convictions for assault, were mentioned by 35% of participants (including all of those who suggested that the boyfriend was responsible for assaulting the child).

In another scenario, a man was found slumped unconscious in a chair in his flat, with knife wounds to his neck and chest, a bloody knife at his feet, with all the windows and doors in his home apparently secure. The police had been alerted by the man's business partner, who had gone to the flat when the man had failed to turn up to work that day. The business partner volunteered the information that he and the man had argued about company profits the previous evening. In their explanations, participants were in less agreement than in the previous scenario: 64% suggested that the man had sustained injuries during an assault, the majority of whom (and 48% of all participants) named the man's business partner as responsible, whereas 31% suggested that it was more likely or at least as likely that he had attempted suicide. In justifying their hypotheses, participants interpreted the same cues differently, making inferences about, and elaborating on, these cues to enhance the plausibility of the chosen hypothesis. For instance, the fact that the doors and windows to the flat appeared secure was used by almost all of those who argued for the suicide hypothesis to support their view that no one else had been involved. The same information was interpreted by those who argued that the man had been assaulted to indicate that his assailant was known to him. Another example was the argument about company profits, which was mentioned by 75% of those who suggested the business partner was responsible, and was interpreted as providing a motive for his actions. The same cue was mentioned by 71% of those who suggested the man had attempted suicide, but in this case was interpreted to mean that he was concerned about a serious problem with his company. Interestingly, none of those who suggested that the man had been assaulted by person or persons unknown mentioned the argument about company profits.

In the third scenario, a taxi driver reported that he had been robbed twice by a male passenger. On the first occasion, the passenger apparently touched the driver's leg and suggested driving somewhere quiet, and on the second occasion he suggested that the driver was frightened of him are made a homophobic remark. The driver said that on both occasions he was frightened, complied with the passenger's requests and gave his takings to the passenger. Participants were even more divided in their theories of what had gone on in this scenario: 41% suggested that the driver had been the victim of a robbery, whereas 29% suggested he was being blackmailed, 10% suggested that he had stolen money for himself, and 20% refused to speculate on what had occurred.

Unlike the previous answers, in which there were relatively few narrative elaborations and inferences, participants' answers for this scenario were dominated by conjecture and story-like reasoning. For those who suggested that the driver had been a victim of a robbery, the most common cues cited were the handing over of money by the driver, and the report by the driver that he was in fear. The most common inferences made were that the passenger had propositioned the driver sexually on the first occasion and had made a threat on the second. In their selection of cues and in their inferences the participants were clearly influenced by the legal definition of robbery, in which (in English law) there is a need to prove that the person committing the offence used, or threatened, immediate forced to steal property from victim. Participants therefore made sense of the incident by generating a story in which the offender deliberately intimidated the driver, who, fearing for his safety, handed over cash on both occasions.

The cues most salient for those who suggested that the driver was being blackmailed, on the other hand, were those relating to the driver's sexual orientation, with 75% of participants in this group inferring that the driver was gay or intended to have sex with the passenger, compared to only 35% in the group of participants who suggested that robbery was most likely. This is suggestive of a readily available prototype script for illicit homosexual interactions, the recall of which is triggered by a few salient cues relating to the passenger's apparent propositioning of the driver and the driver's apparent willingness to drive to a quiet location. Despite the fact that the driver was reporting a robbery, for some participants, cues in the scenario seemed to trigger a blackmail script that overrode a robbery script.

Whilst the striking degree of variation in participants' answers in this final scenario may be attributed in part to conscious or unconscious homophobic bias, an alternative explanation is that the scenario described a situation which it was difficult to fit into a legal script. Although the report claimed to be of a robbery, and many elements in the scenario were inconsistent: the lack of force used, the apparent willingness of the driver to hand over his money, and the failure of the driver to report the crime at the earliest opportunity. Since the incident did not conform to a prototypical of robbery script, officers were forced to generate alternative explanations to account for the facts, and, in doing so, drew on lay theories of threatening interactions, sexual behaviour and interpersonal manipulation.

Whilst these findings now need to be tested under more rigorous and controlled conditions, this exploratory study suggests that officers look for particular cues to help them make sense of the incidents they investigate, and that these cues relate to elements in legally determined scripts: the nature of the crime, and the identity of an offender. The variation in investigative hypotheses appears to depend on the degree to which incidents match legally determined scripts. Where more than one legal script fits, cues are interpreted so as to be consistent with the chosen script. If cues are ambiguous or violate expectations, incidents do not easily conform to a script, officers struggle to make sense of the data, leading to more inferences and speculation, and more variation in the interpretation of particular scenarios.

SENSE-MAKING IN INSURANCE FRAUD INVESTIGATION

The second context, the investigation of fraudulent insurance claims, illustrates the deceptive nature of the scenarios in which investigators undertake sense-making activities. The Association of British Insurers estimated the costs of fraud to the UK insurance industry to be around £1 billion in 2001, suggesting that the cost internationally may be tens of billions per annum. However, the problem affects all policyholders, through increased premiums and in some cases increased exclusions and difficulties in obtaining insurance cover. The majority of insurance claims are genuine, but a worryingly large number are fraudulent. The claimant committing fraud will deliberately construct a claim to appear genuine, and the investigator's job is to look beyond first appearances to see what might lie behind them. Detecting fraud is not easy. Fraud can vary in scale, from inflated claims for genuine incidents through to systematic multi-person 'scams' that involve staged accidents, thefts, and so on. Fraud is also dynamic: as one scam is uncovered, a new one takes its place. Moreover, the need to maintain customer loyalty and efficient sales practices means that the kinds of information checks that can be carried out at policy inception and during the handling of a claim are limited and time-pressured.

The data we discuss in this section come from an empirical study conducted as part of a three-year project developing technologies to enable the early detection and subsequent investigation of potentially fraudulent insurance claims (Ormerod et al. 2003). The study adopted a mixed-methods approach (Ormerod et al. 2004). In particular, we conducted ethnographic studies (e.g., Hammersley and Atkinson, 1983; Ball and Ormerod, 2000) of work practices in different parts of the claims management process. We spent up to eight weeks recording practices at each stage, from telephone-based claims handlers receiving initial claims from customers, through to investigators in specialist units and loss-adjustors from external companies following up claims that have either high value or some initial suspicion associated with them. The study of claims handlers, typically inexperienced staff employed for less than one year, is reported elsewhere (Morley, Ball & Ormerod, in press). Here we focus upon data from the more experienced specialist investigators. We also conducted experimental studies of reasoning and decision-making using research paradigms more commonly found in the JDM literature. However, participants in the studies were expert investigators and claims handlers (contrasted against an out-of-domain student control group) and the materials for the studies were collected during the ethnographic studies.

Ethnographic studies of insurance fraud investigation

In common with the data describing judgments of police officers given in the previous section, explanation-building played a key role in the sense-making activities of skilled fraud investigators. The ethnography field notes contain many examples of investigators constructing explanations around suspicious claims. For example, an investigator followed up an unexpected match between identity details on new and existing motor policies for two separate addresses. The investigator inspected the existing policy and noted that the insured was a flight attendant. She went on to suggest that the insured probably parked her car at her mother's house while she was away at work. Thus, the investigator builds an elaborate but coherent explanation of the anomaly.

Interestingly, and a feature common to many of the explanations (or at least common to parts of them) that we saw generated by expert investigators, the explanation offers a hypothesis of innocence, that is, a way in which an anomaly might be explained as being consistent with a genuine claim or policy application. One of the key differences between the investigative activities of police officers and fraud investigators is the end goal: police officers are seeking a prosecution whereas fraud investigators are seeking repudiation of a claim (i.e., a demonstration that the company is not liable to pay the claim). In essence, the core role of police officers is to endeavor to identify true positives as quickly and effectively as possible (i.e. to prosecute the perpetrators). In contrast, the core role of fraud investigators is to endeavor to identify false positives as quickly and effectively as possible (i.e. to establish that a claim is genuine so that the claimant can be paid and the company's good name upheld). In practice, insurance frauds rarely lead to criminal prosecutions, since there is little for a company to gain financially from legal action. Repudiating a claim or refusing to insure a fraudster in the future have direct financial benefits, while incorrectly refusing to pay a genuine claim can be very damaging to a company's reputation. As a consequence, we hypothesize that explanation-building differs according to whether it is conducted in order to establish a framework of guilt or innocence, and this difference is likely to vary across investigative contexts. The police officers described above seemed almost exclusively to generate explanations imposing a framework of guilt, in contrast to the insurance investigators described here. However, a proper empirical test of this hypothesis has yet to be undertaken.

As a second example of explanation-building, an investigator examined a case that had thrown up an anomaly: checks made by a less experienced claims handler using a government vehicle registration database indicated that a car reported as stolen abroad was, according to records, actually a truck. This kind of mismatch might be taken as evidence that the vehicle is a 'ringer' (i.e., a vehicle that has been stolen and re-registered with the identity of a previously written-off vehicle). The claim was complicated by the fact that the owner could supply no information about the vehicle, except that he bought it from a friend while in Spain. The investigator built the following explanation in response to a query from a less experienced claims handler:

"So his friend takes the vehicle out to Spain, that may be subject to hire purchase. Gets it out there doesn't want to take it back, throws it in as a debt, and then our man may well have found out its true pedigree and thinks how am I going to get out of this one.. it's subject to hire purchase."

Much of this scenario (e.g., the hire-purchase) was not information given in the case notes - it came from the investigator's efforts to build a plausible explanation of the evidence. The hire-purchase explanation is a speculative attempt to provide a coherent narrative that can explain why the sale might have taken place abroad. The investigator went on to pursue an alternative account, in which the vehicle would have been a legitimate purchase.

The generation of alternative explanations is a feature that we found with expert investigators but not with less experienced claims handlers. For example, a search of databases revealed an unexpected match between the details of a third-party's vehicle reported in a claim and the vehicle reported in five claims with other companies. The investigator generated a variety of explanations. First, he proposed that the matches all referred to separate individuals from the same accident (i.e., a hypothesis of innocence, in which a single vehicle is the third party to a number of other vehicles all involved in the same crash). Second, he proposed that it might be duplication (either accidental or deliberate, perhaps by a company insider) of a single claim. Third, he proposed that there might indeed be five separate claims all involving the same third party (who is either very unlucky or involved in some kind of fraud network). Only once he had generated three explanations did he undertake a test (checking whether the claims were made at the same or different times).

Generating explanations under a framework of innocence may reflect the end goals of the fraud investigator, but it has another valuable property: it provides a way of testing the feasibility (and consequently of demonstrating the infeasibility) of suspicious claims. For example, two experienced investigators were dealing with a claim made by a couple who had allegedly been on a day-return shopping trip across the English Channel to northern France, where the insured claimed they had spent nearly 50,000 dollars on jewelry and electrical goods. They claimed that on the return journey, their vehicle had been stolen from a UK service station, along with all the documents concerning their purchases. Under UK law, the burden of disproof rests with the insurance company, even in the absence of any documentation. Inexperienced investigators had previously examined the claim, and had undertaken a trawl of major criminal and insurance databases, which had in turn thrown up large numbers of anomalies and matches against the claimants. However, none of these new pieces of data did the job of repudiating this particular claim, but simply cast more general suspicion on an already suspicious claim. The experienced investigators decided to treat the claim as a genuine one, in order to establish how the day's shopping might have taken place. To do this, they conducted a 'virtual' shopping trip, using the Internet to find out the shortest distance that could have been traveled by the claimants in order to conduct the shopping trip. They were able to demonstrate that the purchases listed by the claimants could not physically have been purchased and collected within a single day in time to get the return ferry. Thus, by adopting a framework of assumed innocence, the investigators were able to repudiate the claim.

Experimental study of investigators' reasoning about insurance fraud

We examined the role played by the end-goal of the fraud investigator in experimental studies of deductive reasoning. Previous studies (e.g. Ellio and Pelletier, 1998) have found that individuals who are given conditional reasoning tasks often draw extra-logical inferences in preference to an invited logical inference. For example, given the conditional statement "If the aeroplane crashes then the pilot will die", and the minor premise "In one case, the pilot did not die", participants often fail to draw the logically valid Modus tollens inference "The aeroplane did not crash". Instead they draw an extra-logical inference such as "He bailed out before the plane hit the ground".

We hypothesized that, in contexts where a conditional statement invites confirmation of a hypothesis of suspicion, similar extra-logical inferences might be drawn by investigators in attempting to set up a framework of innocence. For example, one of the many indicators for a fraudulent claim (in this case, an indicator of a staged theft) that we encountered in the ethnographic studies can be summarized as follows:

If a reported car theft is genuine then the insured will possess both sets of keys.

The minor premise "In one case, the insured did not possess both sets of keys" can be explained either in terms of a logically valid inference "The reported theft is not genuine" or in terms of an extra-logical explanation that creates an account of potential innocence, such as "Maybe the claimant's spouse had lost the spare set". The conditional statement above holds the hypothesis in the antecedent and the evidence that might corroborate this suspicion in the consequent. Combined with the minor premise given above, it invites a logical inference that would confirm a hypothesis of suspicion. The rule components can be reversed, as follows:

If the insured possesses both sets of keys then a reported car theft is genuine.

Given this rule and the minor premise "In this case, the reported car theft was not genuine", the logical inference invites an explanation of an already confirmed suspicion. Thus, we hypothesized that, with rules in which the antecedent

contains the evidence and the consequent contains the hypothesis of suspicions, investigators would be more likely to draw a logically valid Modus tollens inference than with conditional statements where the order of hypothesis and evidence components was reversed.

We compared three groups (N=14 in each group) comprising experienced investigators (more than 5 years experience), claims handlers (with 1 to 3 years experience, handling but not investigating claims) and a non-domain control (undergraduate students). We constructed conditional statements that embodied widely held beliefs concerning fraud indicators, and also a set of materials that embodied general knowledge (e.g., "If the toilet is vacant then the door will be unlocked"). In each of 16 trials, participants were shown a conditional statement and a minor premise designed to elicit a Modus tollens inference. They were asked "to reconcile the fact about this specific case with the given rule - in other words, outline how this set of circumstances might have arisen".

Figure 1 shows the frequency of Modus tollens inferences drawn by each of the three groups for insurance and general knowledge domains with conditionals of each order (hypothesis -> evidence or evidence -> hypothesis). The key finding of this study was that experienced investigators drew significantly fewer logically valid inferences with insurance materials when the premise and rule invited an inference to confirm a hypothesis of suspicion (p< .01). In the same study we also found that expert investigators made fewer logically invalid Denial of Antecedent inferences with conditionals where the evidence came in the antecedent and the hypothesis came in the consequent. Thus, the effect is not simply one of generalized logical competence. Moreover, it seems restricted to insurance materials only.

We interpret this finding as support for our view that expert investigators are cued into adopting a framework of innocence as a strategic refinement to testing suspicions. This framework makes sense in a domain where the key requirement is to repudiate false claims and discriminate them from genuine ones as quickly and reliably as possible. We are testing this hypothesis further in ongoing work in the domain of murder investigations. We predict that we are unlikely to get the same suppression of Modus tollens inferences according to the order in which conditionals are stated. The end-goal of the investigator in a murder investigation is to secure prosecution. Thus, hypotheses of suspicion are most salient and are unlikely to be ignored by investigators in this context whatever the form in which they are encountered.
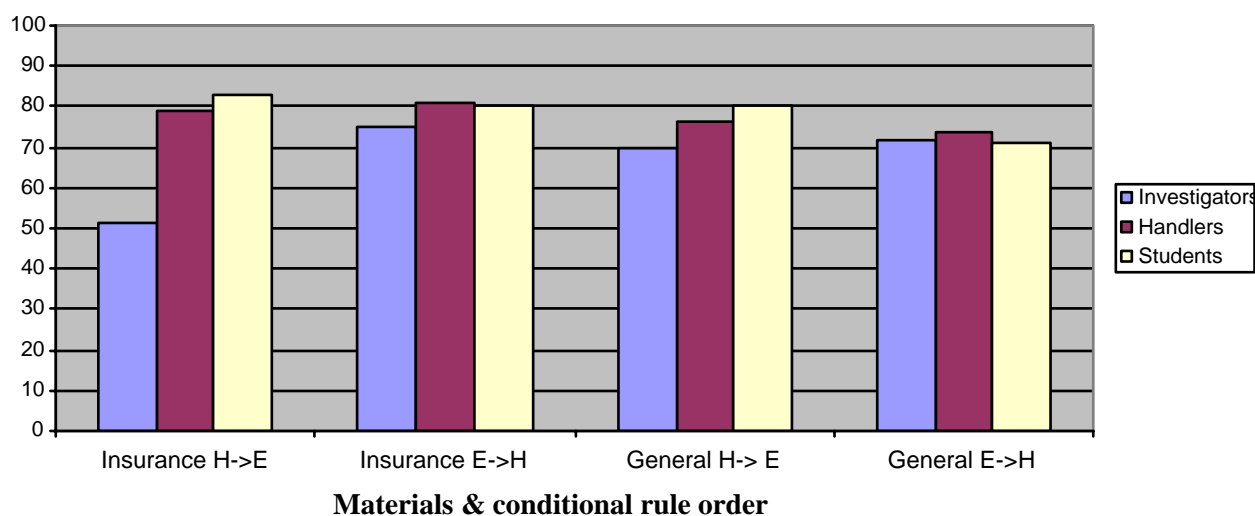

Figure 1. Percentage of logical inferences drawn to insurance-related and general knowledge statements by different participant groups (N-14 per group, four inferences per participant per condition).

SENSE-MAKING IN HOSTAGE NEGOTIATIONS

The third context, hostage/barricade scenarios, illustrates the dynamic and interactive nature of investigative sense-making. It also illustrates the fact that investigative sense-making involves understanding, predicting and responding to the actions, beliefs and justifications of other human agents. Hostage and barricade incidents are "crimes-in-action" in which the police must engage in fast-paced dialogue with a hostage taker to resolve a high-stakes situation. In this scenario, police negotiators rely on what the hostage taker says to guide their decisions and actions. They use salient features of the dialogue to build an understanding of the hostage taker's perspective and concerns, and then attempt to craft their own responses in a way that addresses these concerns and reduces the tensions of the incident (Taylor, 2002). To achieve this sense-making, it is likely that negotiators draw on processes which are similar to that found in the contexts described above. Using information derived from dialogue, negotiators seek to build a hypothetical situation

model about the events that have led up to the current incident. From this model, they formulate a plausible explanation for what has happened and attempt to draw inferences about the hostage taker's current concerns and goals. As the dialogue unfolds, so they gain information that allows the situation model to be developed and their inferences refined to reflect the crime in action at that particular moment.

Existing negotiation research provides some insights into how negotiators make sense of dialogue. Many of the processes that are highlighted parallel those discussed in the previous two contexts. For example, negotiators often report that they use criteria to "classify" interactions in a way that enables them to quickly draw on experience-based, "off-the-shelf" negotiation strategies (cf. Amalberti and Deblon, 1992; DeFilippo, Louden and McGowan, 2002). Similarly, the quantity and ambiguity of information exchanged in dialogue makes it necessary for negotiators to restrict their focus to salient features of recent utterances (cf. Klein, 1993; Taylor and Donald, 2003). The features or cues that become salient are likely to be those that relate to the police negotiator's explanatory model of the hostage taker's initial actions and current motivations. Any anomalies between what the police negotiator believes and what the hostage taker says are likely to prompt further investigative dialogue on that issue.

One process that seems to be particularly prominent in the hostage/barricade context is cognitive framing. At any one time, a hostage taker will communicate about a single issue and it is important for the police to identify and address this issue. This assessment is driven by negotiators' predominant interpersonal perceptions and beliefs about the current dialogue—their motivational framing (Drake and Donohue, 1996) or interpretive schemata (Green, Smith, and Lindsey, 1990). The extent to which negotiators' align their framing determines the extent to which they can make sense of each other's dialogue. Inappropriate framing may lead a police negotiator to interact in ways that make the hostage taker feel misunderstood or unvalued. Appropriate framing, which connects with the hostage taker's perceptions, may enable a police negotiator to demonstrate understanding and present alternative solutions in an effective, persuasive way.

The extent to which police negotiators and hostage takers align their framing of dialogue is therefore expected to play a central role in sense-making and the way in which a negotiation unfolds (Drake and Donohue, 1996). Successful sense-making will be characterized by greater synchrony in the way police negotiators and hostage takers frame their messages, particularly when this synchrony is maintained over a significant number of utterances. When negotiators correctly understand how the other is approaching a particular issue, they are able to exchange information and problem solve. This exchange of information allows them to better understand and adjust to the other's perspective, which in turn facilitates sense-making in the future. Sense-making in interactive contexts is therefore self-reinforcing, and we should expect longer periods of frame synchrony to occur during later stages of negotiation.

While negotiators' overall sense-making is arguably driven by cognitive frames, a second, more immediate process may be responsible for negotiators' choice of frame in the first place. This immediate sense-making is likely to involve a rapid assessment of salient information in a form similar to that identified in the contexts described above. Negotiators must respond to information as it presents itself in the dialogue, and the speed and accuracy with which they evaluate this information determines how well the negotiator is able to appropriately frame the interaction. Research from other contexts suggests that experienced individuals may achieve this sense-making by recognizing salient features of the other party's actions (Klein, 1993). This is consistent with the fact that negotiators are trained extensively in "phase" models of negotiation, which map out the typical changes in framing that occur as a negotiation unfolds (Donohue et al. 1991). Phase models are essentially external (partly legally defined) scripts about how to move through the negotiation process. Combined with experience, they provide an explicit framework that negotiators can draw on to anticipate and interpret changes in dialogue. They provide a way of managing complexity, and we should expect to find evidence of negotiators framing following the pattern of development prescribed by such models.

To test our expectations about the role of cognitive framing and scripts in negotiator sense-making, we coded and analysed dialogue from recordings of 9 actual hostage negotiations. Specifically, we coded each utterance of the dialogue as one of three motivational frames that have repeatedly been found to reflect the major ways in which negotiators use dialogue over time (see Taylor, 2002; Taylor and Donald, 2004 for more information). By examining the ways in which negotiators adjusted their framing across utterances, it was possible to derive an indirect picture of how negotiators were "making sense" of the other's perspective. For example, evidence of rapid shifts in the police negotiator's frame to match the hostage taker's frame would indicate good short-term situational awareness, but if such adjustment occurred consistently over the interaction it would also suggest that the police negotiator was unable to generate any longer-term synchrony in framing.

One of the most striking findings to emerge when examining negotiations in this manner is how often police negotiators and hostage takers match one another's frame. Framing was found to be consistent for an average of 8.89 consecutive utterances, with sequences of three or more equivalently framed utterances occurring in 78% of the 9 negotiations. However, as expected, the extent to which negotiators matched one another's framing varied between negotiations that ended peacefully and those that did not. Negotiations that ended unsuccessful showed a small gradual decrease in the length of synchronous framing over time, while successful negotiations were associated with an increase in frame alignment over time. This increase in frame alignment was four-times the magnitude of the decrease associated with

unsuccessful incidents. In the interactive context, how negotiators made sense of issues in the initial stages seems to significant effect their ability to make sense of the other's utterances during later stages of interaction.

The evident importance of early framing on later sense-making highlights the need to uncover the process that underlies negotiators' initial assessment of dialogue. To derive an understanding of this process, we examined the 22% of dialogue in which negotiators did not have congruent frames. These dialogues reflect transitional periods during which negotiators seek a common frame, such that understanding these periods may inform our understanding of how frames are chosen by negotiators. To examine the make-up of these transitions, we counted the contingencies among different utterance frames and noted which of the two negotiators initiated the subsequent sequence of synchronous frames. Results showed that police negotiators typically adopted a significantly less dominant role during the transitional periods. They switched their personal framing to match the hostage taker's frame more frequently than was the case in non-transitional periods, and they reduced the average length of their utterances. In effect, they reduced their role in the interaction, which potentially allowed for increased prominence and greater recognition of the hostage taker's perspective.

However, while police negotiators took a passive role in moving through transitional periods, they often took a dominant role in determining the next period of synchronous framing. How they acted depended on the stage of the negotiation. Specifically, during early stages of negotiation, the police negotiators remained passive when hostage takers focused on instrumental (substantive) issues, but took an active role in promoting dialogue framed around relational or identity issues. In contrast, during later stages of interaction, police negotiators typically took the lead when responding to instrumentally framed utterance, but remained passive when dialogue focused on relational or identity issues. This was particularly true of successful negotiations, where police negotiators were significantly more likely to "pick up" on a hostage taker's temporary instrumental framing of dialogue in a way that generated a prolonged period of frame synchrony. This change in the focus of frame initiation is consistent with phase models of interaction, and it is consistent with the possibility that negotiators draw on cognitive scripts to focus their sense-making efforts.

The analyses in this section sought to provide a preliminary investigation of sense-making in hostage negotiation. In such a dynamic scenario, sense-making involves more than a heuristic-led reaction to possible negotiation payoffs (e.g. Bazerman et al. 2000). It involves a fast-paced, evolving assessment of hostage taker's actions and reactions, which draws on cognitive frames that simplify the necessary interpretation of the hostage-taker's utterances, and learned negotiation scripts that help negotiators anticipate the motivations underlying hostage takers' dialogue.

Conclusions

Investigators working in criminal contexts build complex explanations to flesh out possible crime scenarios, motives and modus operandi. They do so by structuring available evidence around internalized cognitive frames and also externally-imposed legal scripts that determine likely courses of events. In addition, they appear able to adopt different inferential stances that allow them to evaluate multiple suspicion hypotheses against potential frameworks of guilt or innocence. A central feature of explanation-building in experts' sense-making seems to be creating narratives that include more evidence than is strictly necessary to build up an account, or even that go beyond the immediate evidence. Extending explanations to develop a rich narrative allows the expert to test the plausibility of potential hypotheses in a rapid depth-first exploration (cf. Ball and Ormerod, 2000). It also presents a method for seeking alternative hypotheses or motives. The empirical studies described above point to a set of skills underlying investigative sense-making that seem more complex than perceptually-based situation awareness that triggers single decision rules. In adopting this view, we are rising to the challenge set by Yates (2001) in his review of NDM research, where he identifies explanation construction as potentially a key component of expert judgment.

Interestingly, some of the empirical examples of explanation-building that we present above share characteristics of the so-called 'conjunction fallacy' identified in the JDM literature (Kahneman, Slovic and Tversky 1982). So, for example, in the Linda problem, participants are given a stereotypical description of an individual ('Linda') and asked to rate the likelihood of two or more conclusions (e.g., "Linda is a bank teller" versus "Linda is a feminist bank teller"). Participants rate the conjunctive conclusion ("Linda is a feminist bank teller") as most plausible when it is consistent with the stereotype given in the description. This judgment is a logical 'fallacy' if the task is simply to derive a probabilistic judgment of separate conclusions since the singular conclusion is a subset of the conjunctive conclusion. However, reconceived as an explanation-building task, the selection of the conjunctive conclusion makes perfect sense: it offers a coherent explanation of the largest subset of evidence available in the description. So, for example, in the vignette where a grandmother reports bruising on a child, logically the most probable conclusion is simply that the child has been abused, but officers tended to draw a conjunctive conclusion that the child had been abused by the mother's violent boyfriend. In this context, it would almost be irresponsible of the investigators to ignore the conjunctive possibility in favor of the singular conclusion.

That said, part of the sense-making skills of an investigator is derived from an ability to step back from conjunctive conclusions and to consider alternative and weaker hypotheses (e.g., the child may have been abused but maybe not by the violent boyfriend). One strategy for generating alternatives is to treat each of the propositions in a conjunctive conclusion as a separate building block for a line of enquiry. So, for example, we described above an insurance investigator developing three separate explanations for the conjunction of evidence in which a third party vehicle appears in multiple claims. A standard tenet of problem-solving is the notion of satisficing (Simon, 1981), the idea that individuals will expand on one solution possibility at the expense of alternatives as a way of controlling search through a potentially infinite problem space. Satisficing is implicit in recognition-primed decision-making (Klein, 1989), since the expert makes a single rapid and seemingly intuitive judgment from which decisive action follows. This kind of sense-making works particularly effectively in contexts such as emergency response, where to dwell on consideration of multiple possible views might delay action, with potentially negative consequences. In contexts of criminal investigation, however, we suggest that satisficing is an inappropriate approach (though quite possibly one found with less effective or experienced investigators). Expert investigators should generate alternative explanations: investigation is rewarded by divergent thinking not convergent recognition.

In the course of investigating crimes being planned (e.g. disruption of drug traffickers), crimes under commission (e.g. during a hostage/barricade incident), or crimes that have already been committed (e.g. a murder investigation), police officers and insurance investigators take actions that impact on the behavior of their target. Sense-making is, therefore, a dynamic, ongoing process of understanding and anticipating the target's likely reaction to investigative action. This dynamic characteristic is shared by other expertise domains. For example, the actions a pilot takes to remedy a fault can change the situation that is faced sometimes quite dramatically, a point neatly exemplified by Orasanu, Martin and Davison (2001) of the Kegworth Boeing 737-400 crash of 1989 in which the pilot isolated the wrong (i.e., functioning) engine in trying to deal with a suspected engine fire (p.212).

What makes the dynamism of investigative domains different is the deliberate intent on behalf of the perpetrators of crimes to mask the true causal structure of an incident. It turns out that expert investigators can use an expectation of deliberate deception to good effect. If you expect to be deceived, then you can construct tests that force the perpetrator to expand upon their deception until a point where the deceptive story becomes unsustainable. In the domain of insurance fraud, this process is called setting 'elephant traps', where seemingly innocuous lines of questioning can be pursued that inevitably demonstrate a claimant is lying. In some respects, accidental (i.e. unexpected) deception is much more problematic because the expert cannot prepare for it, and indeed, their expertise is undermined by it. For example, in the Kegworth air crash, the action of turning off a functioning engine had the effect of removing a vibration that served as a cue to malfunction, thereby falsely confirming the pilot's diagnosis. Knowing that you will be deceived in a criminal context provides a powerful investigative lever, and it is a lever that is used to good effect in sense-making by skilled investigators.

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