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## Distributed Cognition at the Crime Scene

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2 **Distributed cognition at the crime scene**

3 **Chris Baber**

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6 **Abstract** The examination of a scene of crime provides  
7 both an interesting case study and analogy for consider-  
8 ation of Distributed Cognition. In this paper, Distribution is  
9 defined by the number of agents involved in the criminal  
10 justice process, and in terms of the relationship between a  
11 Crime Scene Examiner and the environment being  
12 searched.  
13

14 **1 Introduction**

15 The examination of a crime scene is subject to all manner  
16 of legal, ethical and scientific imperatives, and the evidence  
17 collected will be subjected to inspection by a variety of  
18 individuals with different intentions, skills and knowledge.  
19 In this paper, I will suggest that Crime Scene Examination  
20 presents an interesting and challenging domain in which to  
21 consider the notion of Distributed Cognition for the simple  
22 reason that it is not always apparent where the act of  
23 'cognition' is situated. The ultimate aim of the criminal  
24 justice process, of course, is to acquire evidence which can  
25 be combined with information from other sources in order  
26 to produce a case that can be tried in Court. Contrary to its  
27 representation in popular fiction, the examination of a  
28 crime scene is unlikely to yield evidence that immediately  
29 links a suspect to a crime. Rather, the collection of evi-  
30 dence is part of a complex web of investigation that  
31 involves many individuals, each considering different  
32 forms of information in different ways. Thus, the paper

begins with a cursory description of the role of the Crime  
Scene Examiner (CSE) within the criminal justice process. 33 34

The CSE is part of a much larger investigative system, 35  
each member of which has their own skills and roles 36  
(Smith et al. 2008). In a sense, Crime Scene Investigation 37  
involves sets of ad-hoc teams pursuing independent goals 38  
with quite limited overlap (Smith et al. 2008). Thus, there 39  
is typically a demarcation between roles. Having said this, 40  
the nature of this demarcation has been subject to signifi- 41  
cant shifting over the years, with the ongoing digitisation 42  
of Crime Scene Examination leading to further changes. 43  
For example, there used to be a specific role of Crime 44  
Scene Photographer whose function was to capture and 45  
process images of the crime scene (either prior to evidence 46  
recovery or at stages during the recovery process, 47  
depending on the nature of the crime). However, with the 48  
growing use of digital cameras by CSEs, this role has (in 49  
some Police Forces) changed. This has the interesting 50  
implication that the function of a photograph taken by the 51  
Crime Scene Photographer was to capture the scene as 52  
clearly as possible in order to aid discussion of the scene in 53  
Court (or during subsequent investigation), but the function 54  
of a photograph taken by the CSE *could* be to illustrate the 55  
evidence recovery process; I suggest this because the 56  
capturing of images by the CSE is *part* of the activity being 57  
undertaken rather than the sole focus of the activity. 58  
Whether or not similar changes might arise in terms of 59  
specialised analysis of fingerprints, footwear marks, DNA 60  
and other evidence is a matter of continued debate. For the 61  
time being, these analyses are generally performed by 62  
Forensic scientists rather than by CSEs. This means that 63  
one of the primary roles of the CSE is the recovery of 64  
evidence and its transportation in a usable state to the 65  
laboratory of the Forensic scientist. How this recovery and 66  
transportation is performed, and how closely the Forensic 67

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68 scientist and CSE cooperate depends very much on the  
69 nature of the crime being examined. For much of our work,  
70 we have focused on what is called ‘Volume Crime’ (e.g.,  
71 robbery, burglary), as opposed to ‘Serious Crime’ (e.g.,  
72 murder, rape, kidnapping). In Volume Crime, it is likely  
73 that the recovered evidence is passed onto the Forensic  
74 Scientist via a third party (sometimes called the ‘Evidence  
75 Manager’). This means that any information pertaining to  
76 that item needs to be carefully and comprehensively  
77 recorded by the CSE prior to depositing with the Evidence  
78 Manager. It is this combined process of recovery, storing,  
79 labelling and transportation of evidence that forms the  
80 basis of several forms of computer-based CSE support (i.e.,  
81 evidence management systems). Before exploring this  
82 further, we consider the archetypal detective and his  
83 approach to investigating crimes.

## 84 2 Sherlock Holmes and reasoning about crime

85 Sherlock Holmes tells a visiting stranger “You have come  
86 up from the South–West I see” observing that the “...clay  
87 and chalk mixture which I see upon your toes caps is quite  
88 distinctive.” (Doyle 1989, p. 176, *The five orange pips*).  
89 This ability to draw correct conclusions from visual evi-  
90 dence is one of the hallmarks of Holmes’s powers, and  
91 implies a particular form of reasoning. Holmes’s method is  
92 a form of *induction* which involves the careful observation  
93 of the environment in order to develop hypotheses and then  
94 performing a process of elimination among a number of  
95 alternative possibilities, that is, “...eliminate all other  
96 factors, and what remains must be the truth.” (Doyle 1989,  
97 p. 66, *The sign of four*). So that, “one simply knocks out all  
98 the central inferences and presents one’s audience with the  
99 starting-point and the conclusion, [so that] one may pro-  
100 duce a startling, though possibly a meretricious, effect.”  
101 (Doyle 1989, p. 583, *The adventure of the dancing men*).  
102 He would often present his conclusions as the result of  
103 deduction (i.e., ‘Elementary, my dear Watson’) and imply  
104 that he was able to draw a conclusion from general prin-  
105 ciples to a specific observation; indeed, Holmes would  
106 often refer to his method as *deduction*. One could argue  
107 that Holmes was attempting to apply a deductive method  
108 (through his exposition of premises) but was hampered by  
109 Doyle’s insistence of continuing to add extra pieces of  
110 evidence, which forced him into an inductive method.

111 This distinction between induction and deduction is  
112 based on a broad characterisation of the approaches as rival  
113 positions, namely induction as ‘observations leading to  
114 theory’, and deduction as ‘theory guiding observation’. In  
115 reality it can be difficult to separate the two, and difficult to  
116 conceive of the ‘pure’ application of induction (which  
117 would involve the compiling of observations in a manner

118 which was theoretically agnostic, and the subsequent  
119 development of a theory which was *solely* based on those  
120 observations). One would assume that observations will be,  
121 in some sense, selective and that this selectivity could be  
122 tuned by attention to specific aspects of the environment.  
123 The point of this discussion is to raise a key issue for Crime  
124 Scene Examination; there is a supposition that the work of  
125 the CSE involves the ‘harvesting’ of materials which  
126 would then be analysed by Forensic Scientists. CSEs are  
127 supposed to maintain neutrality in terms of collecting  
128 evidence and to conduct their work in an inductive manner,  
129 because any sense in which they are interpreting the scene  
130 could be construed as a potential for bias in the investi-  
131 gation. Of course, Holmes never had to face such accusa-  
132 tions because, as a literary character, he was not guilty of  
133 bias (only of revealing the information given to him by his  
134 author) and did not have to justify his interpretations under  
135 cross-examination in Court. The question of how Crime  
136 Scene Examination treads the line between induction and  
137 deduction is explored later in this paper; before this we will  
138 consider the notions of Distributed Cognition that underlie  
139 our studies.

## 3 Distributed cognition

140 The notion that cognition can be ‘distributed’ has been  
141 developed over the past couple of decades (Artman and  
142 Waern 1999; Artman and Garbis 1998; Busby 2001; Flor  
143 and Hutchins 1991; Furness and Blandford 2006; Hollan  
144 et al. 2002; Hutchins 1995a, b; Hutchins and Klausen 1998;  
145 Perry 2003; Rogers and Scaife 1997). While I suggest that  
146 Crime Scene Examination necessarily involves several  
147 agents performing cognitive activity, this is not to argue  
148 that this results in an ‘extended mind’ across these agents;  
149 as Dror and Harnand (2009) point out, to argue for an  
150 extended mind is analogous to arguing for extended  
151 migraine—just because an event occurs in one brain does  
152 not inevitably mean that other brains will share this event.  
153 Dror and Harnand’s (2009) argument is that one should not  
154 separate cognitive states from mental states. This criticism  
155 raises a core problem for the notion of ‘Distributed Cog-  
156 nition’, because it implies that cognition cannot be ‘dis-  
157 tributed’ across agents because one cannot share mental  
158 states. A primary assumption of ‘Distributed Cognition’ is  
159 that it is not ‘cognition’ which is distributed so much as  
160 objects-in-the-world, which plays a role in supporting,  
161 structuring and aiding the activities of cognition. “A main  
162 point of departure from the traditional cognitive science  
163 framework is that, at the ‘work setting’ level of analysis,  
164 the distributed cognition approach aims to show how  
165 *intelligent processes in human activity transcend the*  
166 *boundaries of the individual actor*. Hence, instead of  
167



168 focusing on human activity in terms of processes acting  
 169 upon representations inside an individual actor's heads the  
 170 method seeks to apply the same cognitive concepts, but this  
 171 time, to the interactions among a number of human actors  
 172 and technological devices for a given activity." (Rogers  
 173 1997, p. 2). This quotation hints at two notions of an  
 174 'extended mind'. For example, some theorists claim that  
 175 the mind can become 'extended' through its interactions  
 176 with the environment, for example "...certain forms of  
 177 human cognizing include inextricable tangles of feedback,  
 178 feed-forward and feed-around loops; loops that promiscu-  
 179 ously criss-cross the boundaries of brain, body and world."  
 180 (Clark 2008, p. xxviii). Thus, as we shall in the section  
 181 entitled 'Inspection and Examination', objects-in-the-world  
 182 (and the representations made of them) form resources-for-  
 183 action through their ability to afford specific responses. In  
 184 addition, the crime scene examination process also features  
 185 a distribution of tasks. What is particularly interesting,  
 186 from the point of view of Distributed Cognition, is that the  
 187 process of 'find-recover-analyse-interpret-conclude' is  
 188 divided between two or more people, with quite limited  
 189 communication between them. The CSE might perform the  
 190 'find-recover' tasks to gather potential evidence and then  
 191 submit this for the 'analyse-interpret' tasks by a Forensic  
 192 Scientist, who would then pass the results onto the Officer  
 193 in Charge of the case with a probability to guide the pre-  
 194 liminary 'conclude' tasks. The Officer in Charge would  
 195 then combine this evidence with other information to raise  
 196 a hypothesis and add this to a Case file which would be  
 197 passed to the Crown Prosecution Service. This hypothesis,  
 198 if maintained, would then be tested in Court by Barristers  
 199 presenting a case for and against an individual.<sup>1</sup> Each step  
 200 of this process would be documented and conclusions  
 201 drawn in such a way as to avoid potential bias.

202 One could draw an analogy between 'extended mind'  
 203 and the debate over 'broad' and 'narrow' mental content in  
 204 Philosophy. The notion of 'narrow' content might assume  
 205 that a person's belief about something could be defined  
 206 entirely by their intrinsic characteristics (and would not  
 207 change with any changes in their environment). The notion  
 208 of 'broad' content, on the other hand, is inextricably tied to  
 209 the person's environment. For example, Putnam (1975)  
 210 contrasted beliefs about the concept 'water' between Earth  
 211 and 'Twin Earth'. Twin Earth was exactly the same as  
 212 Earth, with the exception that the chemical properties of  
 213 that element termed 'water' were different (although the  
 214 observable properties were the same on Earth and Twin  
 215 Earth). Putnam's (1975) claim was that, given identical  
 216 individuals on Earth and Twin Earth, when either spoke

about 'water' they would be referring to something dif-  
 ferent. This means that the intrinsic characteristics of these  
 two identical individuals would not be sufficient to deter-  
 mine the meaning of the word 'water', but that there needs  
 to be some reference to external environment. This leads  
 Putnam (1975) to make the well-known assertion that  
 "...meanings' just ain't in the head." (p. 227).

Relating this discussion to the earlier contrast between  
 Sherlock Holmes and contemporary CSE, we could suggest  
 that Holmes represents the application of 'narrow' content;  
 the world and its machinations exist solely through his (or  
 rather, Doyle's) description of them and this description  
 cannot be challenged (simply because the stories rarely  
 include the opportunity to develop alternative explana-  
 tions). In contrast, the CSE is involved in the application of  
 'broad' content; the world is represented as evidence which  
 is passed between different people who can offer different  
 interpretations to bear on it. From this perspective, the  
 question becomes a matter of how representations are used  
 rather than a matter of *individual* interpretation (because  
 these interpretations will always, in an adversarial legal  
 system, be open to dispute).

#### 4 Distributing examination

While Sherlock Holmes provides an entertaining version of  
 logical analysis (and serves as a template for contemporary  
 television equivalents), his approach has many differences  
 with modern Crime Scene and Forensic Examination.  
 Obviously, Crime Scene Examiners do not have the benefit  
 of the omniscient author guiding the discovery and inter-  
 pretation of evidence, nor do they have the opportunity to  
 present their findings to an informal (usually incredulous)  
 gathering of people, as could Holmes. More importantly,  
 Holmes's form of inductive reasoning requires the proba-  
 bilistic elimination of competing hypotheses to explain a  
 well-defined piece of evidence. The notion of a well-  
 defined piece of evidence concerns the relationship  
 between recognising something as having potential evi-  
 dential value and the interpretation of that evidence in  
 terms of other information. For Holmes (and his modern,  
 fictional counterparts), this all takes place in the head of  
 one person; so the processes are typically assumed to  
 involve the mental states of a single individual.

Crime Scene Examination can be considered 'distrib-  
 uted', in a trivial sense, in that several people are involved  
 in the interpretation of evidence, each providing a partic-  
 ular perspective on this interpretation. What we see in  
 Sherlock Holmes is a literary representation of the many-  
 headed being of the criminal justice process in the body of  
 a single individual. As crime scene examination grew  
 increasingly 'scientific' so the division of tasks into

<sup>1</sup> This example follows the legal system in England and Wales; while  
 other countries will follow different processes, the point is that several  
 people are involved in the interpretation of evidence.

267 discrete specialisms (each with a defined skill set) devel- 320  
 268 oped (Horswell 2004). Thus, it is typical for the Crime 321  
 269 Scene Examiner and Forensic Scientist to have followed 322  
 270 different career paths and have different skill sets (and,  
 271 furthermore, for there to be a growing variety of special-  
 272 isms within Forensic Science). Two further factors in the  
 273 ‘distribution’ of Crime Scene Examination arise from the  
 274 ‘civilianisation’ of CSE activity (the recruitment of per-  
 275 sonnel to this function from outside the Police Force) and  
 276 the establishment of specific CSE units (outside the oper-  
 277 ation of separate Police stations). Each of these factors can  
 278 be related to imperatives of economic and efficiency gains,  
 279 but they have a bearing on how knowledge of criminal  
 280 behaviour is shared and applied. For example, an under-  
 281 standing of criminal behaviour, gained over years of  
 282 policing, could help interpret evidence; but recruiting  
 283 civilian staff to these posts might remove the opportunity to  
 284 gain knowledge and experience from policing. This could  
 285 be dealt with through the training and exposure of new  
 286 CSE personnel, or through the integration of CSE activity  
 287 with other police activity. This relates to the second point,  
 288 namely the removal of a CSE from local police stations to  
 289 centralised services, which implies the need for a means of  
 290 sharing experiences and knowledge. Thus, if there is a set  
 291 of similar cases in an area (say a string of burglaries with  
 292 similar ways of gaining access to a building), then one  
 293 would expect a link to be made between them. However, if  
 294 each case is investigated by different individuals, then it  
 295 might not always be possible to explore such links.

296 What is happening in Crime Scene Examination is the 324  
 297 mediation of cognition through the collection, manipulation 325  
 298 and dissemination of a variety of artifacts; each artifact 326  
 299 is interpreted in particular ways by the agents who come into 327  
 300 contact with it. My argument will be that, for the various 328  
 301 agents involved in this evidence chain, each artifact can 329  
 302 ‘afford’ a particular set of responses, that is, the artifacts are 330  
 303 resources for action, and the actions will be recognised by 331  
 304 different agents according to their training and experience. 332  
 305 I am using the notion of ‘afford’ in the sense introduced by 333  
 306 Gibson (1977, 1979), as a form of perception–action cou- 334  
 307 pling in which the physical appearance of an object in the 335  
 308 world supports particular physical responses (e.g., a pebble 336  
 309 ‘affords’ grasping in the hand). Thus, the design of artefacts 337  
 310 that are used in a work environment become changed by 338  
 311 their use, and these changes provide cues for subsequent 339  
 312 use (Bang and Timpka 2003; Nemeth 2003; Seagull et al. 340  
 313 2003). What makes this a challenging domain for dis- 341  
 314 cussing Distributed Cognition is that the manipulation of an 342  
 315 artifact by one agent might have a significant bearing on the 343  
 316 state of the artifact, which could interfere with the activity 344  
 317 of other agents, e.g., a simple example would be the need to 345  
 318 preserve a crime scene so as to protect evidence from 346  
 319 contamination conflicting with the need to retrieve specific 347  
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items of evidence, or the need to dust a surface to reveal  
 fingerprints conflicting with the need to photograph the  
 scene.

## 5 Inspection and expectations 323

In their study of Crime Scene Examination, Schraagen and  
 Leijenhorst (2001) recorded verbal protocols of the  
 examination of a staged crime scene. They suggested, for  
 the analysis of these protocols, that the experienced Crime  
 Scene Examiner develops a narrative of the crime, for  
 example considering how a person might have gained  
 access to the building, what path they might have followed,  
 what actions they might have performed, etc. This narrative  
 would probably be intertwined with the search activity,  
 such that the narrative would influence the search and the  
 search would influence the narrative. In a similar vein,  
 Ormerod et al. (2008) suggest that “...expert investigators  
 ... [call] ... upon internalized cognitive frames relating to  
 human behaviour that allow them to generate expectations  
 about the actions and responses of others in real time.”  
 [Ormerod et al. 2008, p. 82].

In studies using ASL MobileEye, a head-mounted eye-  
 tracking system, we asked Crime Scene Examiners to  
 inspect a set of staged crime scene. In one study, we  
 compared performance of three experienced Crime Scene  
 Examiners and three Undergraduate students to search the  
 same room under the same conditions. Of the many obvi-  
 ous and striking differences between the two sets of  
 recordings, we noted that the students had a tendency to  
 search only around locations that they believed to have  
 links with stolen items—and so their narrative was focused  
 solely on the loss of objects. The Crime Scene Examiners  
 had a far more detailed narrative to guide their search and,  
 as the stills from one recording shown later illustrate, spent  
 a substantial part of their time looking at the door and  
 noting possible evidence that could be recovered, e.g.,  
 blood stains near the latch, tool marks made by a chisel on  
 the door frame, a footprint on the outside of the door.

Discussion with the Crime Scene Examiners showed  
 how experience played a key role in deciding where to look  
 for evidence and how best to examine the scene. For vol-  
 ume crime, the Crime Scene Examiner might walk the  
 scene with the victim in the first instance, and then return  
 to key locations to look for possible evidence. There was  
 some debate as to what should be the first location to  
 search. Standard practice might say that one begins with  
 the Point of Entry and examines that thoroughly. In Fig. 1,  
 the Point of Entry involved forcing an office door, possibly  
 with a tool that had a sharp end, such as a chisel, which  
 resulted in cuts around the latch. Fingermarks on the door  
 could have been left during entry (or exit) and suggest that





**Fig. 1** Stills taken from mobile eye-tracker worn by Crime Scene Examiner inspecting a staged break-in (fixation indicated by cross in thick circle)

370 the entrant had cut the right thumb. Comparison between  
 371 experienced CSEs and the untrained Engineering students  
 372 with *no* experience of CSE work showed clear distinctions  
 373 in search pattern; whereas the students all walked into the  
 374 room without looking at the door, the CSEs all spent  
 375 around 20% of their total search time inspecting the door  
 376 before proceeding to the rest of the room. There are two  
 377 plausible explanations for this. The first is that this scene  
 378 (which had been staged to replicate an office break-in) had  
 379 conspicuous evidence on and around the door. However,  
 380 this evidence was not so conspicuous that the students  
 381 noticed it. The second is that the CSEs expect to find  
 382 evidence at Point of Entry and so attend to this in detail.  
 383 The CSEs, after the study, stated that this approach was  
 384 ‘intuitive’ and ‘just felt right’. In their discussion of intuition  
 385 in problem solving, Dreyfus and Dreyfus (1986) noted that  
 386 “intuition is the product of deep situational involvement  
 387 and recognition of similarity...; [and becomes  
 388 expertise when] not only situations but also associated  
 389 decisions are intuitively understood.” (Dreyfus and  
 390 Dreyfus 1986, p. 18). This notion is analogous to Klein’s  
 391 notion of Recognition-Primed Decision-making (Klein  
 392 et al. 1986). In Recognition-Primed Decision-making  
 393 (RPD), one can infer three broad approaches that the  
 394 decision-maker might follow; (i) the situation is recognised  
 395 as ‘typical’ and an associated set of activities would be  
 396 brought to mind; (ii) the situation is defined in terms of  
 397 core features, each of which would be developed in terms  
 398 of (i); and (iii) the situation is unusual, and the person  
 399 might mentally explore alternative strategies prior to

400 committing to a set of activities. This study, and discussion  
 401 with the Crime Scene Examiners, implies that the situation  
 402 was defined in terms of (ii), and that each aspect would be  
 403 considered in terms of a set of activities. The Point of Entry  
 404 was explored in terms of recoverable DNA, fingerprints,  
 405 and toolmarks (possibly in this order because each might  
 406 be considered to have different levels of permanence and  
 407 need to be recovered quickly). In a similar manner, Flin  
 408 et al. (2007) have suggested that operational policing  
 409 involves recognition of situations and the subsequent  
 410 elicitation of appropriate response scripts, so this example  
 411 of CSE suggests a three-step process by which a set of  
 412 ‘typical situations’, such as Point of Entry, are used to  
 413 guide search of a scene, which then leads to attention to  
 414 items of potential evidential value, and then interpretation  
 415 of these items. Thus, we could reverse Klein’s RPD to  
 416 describe the activity of the CSE as Decision-Primed Recognition.  
 417 This is not a huge step in terms of Klein’s notion  
 418 of RPD because it simply follows the perception–action  
 419 cycle that RPD implies: The recognition of features in the  
 420 environment are responded to in terms of decisions based  
 421 on previous experience, and these decision, in turn, can  
 422 help shape expectations of what to look for in the environment  
 423 (and to help interpret what one is looking at).

424 A second study concerned compared first students on a  
 425 crime scene examination and forensics degree and experienced  
 426 crime scene examiners. In one condition, there was a  
 427 search of a ransacked office (again the scene was staged).  
 428 Figure 2 shows a set of stills taken from an experienced  
 429 Crime Scene Examiner opening the office door and



**Fig. 2** Series of images from eye-tracking worn by experienced CSE inspecting a ransacked office

430 immediately noticing a black mark on the floor (a), closer  
431 inspection indicates that this is a footwear mark (b) and,  
432 during the course of subsequent searching a plastic bag is  
433 found under a table and a pair of shoes found in the bag—the  
434 shoes have a black substance on their sole and the tread  
435 looks similar to that in the footwear mark (c). The scene  
436 had been staged to look as if an opportunistic thief had  
437 broken into the office and stolen money from a petty-cash  
438 tin (which was left open on top of the desk). However, in a  
439 twist in the scenario, we had staged the scene to actually  
440 reflect an ‘insurance job’, that is, the office’s owner had  
441 staged the crime to claim on his insurance for loss of cash,  
442 personal possessions and some computing equipment.

443 Most of the evidence in the scene could have been used  
444 to support the conclusion of an opportunistic crime, which  
445 was the conclusion of all five students and two of the CSEs.  
446 There were three crucial pieces of evidence which pointed  
447 to the alternative conclusion (the shoes, as shown in Fig. 2;  
448 the fact that the window looked to have been forced but  
449 with no obvious evidence of it being used as a point of exit,  
450 particularly as it was some 15’ off the ground; the order in  
451 which the desk drawers had been opened<sup>2</sup>).

452 The stills in Fig. 2 show an additional aspect of the  
453 CSEs exploration of the scene. As well as being guided by  
454 their experience of likely places to search for evidence,  
455 they need to maintain a running commentary of recovered  
456 evidence so as to be able to compare subsequent finds.  
457 Interestingly, the two CSEs who did not link the shoes to  
458 the footwear mark had previously dismissed the marks as  
459 ‘smudged’ and ‘not worth recovering’. This implies that  
460 the mark was no longer part of their running commentary,  
461 and so the potential value of the shoes was not explored.  
462 The question of how a ‘running commentary’ is developed  
463 and indexed during a search activity could be worth further  
464 investigation. Studies of Distributed Cognition demonstrate  
465 ways in which objects-in-the-world structure cognition.

<sup>2</sup> In order to prevent one drawer obscuring the contents of the next, and in order to prevent the need to close drawers, the experienced criminal is likely to open drawers from the bottom up—but in this scene, we had obviously opened them top down.

466 Often these objects-in-the-world are purpose-built to sup-  
467 port specific cognitive activities, or are adapted from  
468 existing objects. Researchers would then either focus on  
469 the design of such objects, and their ability to support  
470 cognition or at ways in which activities result in the  
471 modification of objects. Crime Scene Examination repre-  
472 sents a special case, in that the objects-in-the-world to  
473 which the person attends have been neither designed nor  
474 adapted to suit a specific cognitive activity. Rather, the  
475 objects have to be discovered by the person and then  
476 interpreted in terms of their relevance to the task of gath-  
477 ering evidence. In this manner, the tasks of discovering  
478 objects-in-the-world that could have evidential value can  
479 be considered a form of recognition-primed decision-  
480 making.

## 6 Evidence recovery 481

482 As mentioned previously, one requirement of Crime Scene  
483 Examination is to select items that *could* be of evidential  
484 value. This means not only finding visible items, but also  
485 preparing surfaces so that less visible, or latent, items can  
486 be revealed. Figure 3, for instance, shows how a surface  
487 can be prepared to lift fingerprints. In this instance, the item  
488 being inspected (a glass bottle) is being dusted with alu-  
489 minium powder using a brush. The brush is applied to the  
490 item using a swirling motion to ensure a light, even cov-  
491 erage. The process involved a period of brushing (for  
492 around 10 s), followed by a visual check (for about 5 s in  
493 which the bottle was gently rotated to catch light falling on  
494 any revealed marks), and then a repeated period of  
495 brushing prior to the use of tape to lift the revealed marks  
496 (or, more recently, the use of high-resolution digital pho-  
497 tography to capture the marks) to transport them to the  
498 laboratory. In some instances, the visual check might be  
499 supplemented through the use of a handtorch which shone  
500 orthogonally to the powdered surface. In the inspection  
501 shown in Fig. 3, the torch was not used but the CSE could  
502 be seen to be rotating the bottle to catch available light



Fig. 3 Dusting for fingerprints

Author Proof

503 during the visual check phase. Concurrent verbal protocol  
 504 during the search suggested that the CSE initially concen-  
 505 trated on two areas that were anticipated to reveal  
 506 marks—and there was an assumption that each area would  
 507 reveal different types of mark. Around the neck of the  
 508 bottle, the search was initially for marks from fingertips  
 509 and thumb holding the bottle vertically (as if carrying it)  
 510 and around the middle of the bottle the search was for  
 511 marks of the bottle resting across the middle of the fingers  
 512 and being controlled by the thumb. Thus, a schema of how  
 513 the bottle could have been used influenced the initial  
 514 search.

515 While there are procedures in place for the recovery and  
 516 analysis of finger marks, work by Dror et al. (2005) high-  
 517 lights how their interpretation could be biased with the  
 518 provision of additional contextual information. In this  
 519 study, contextual factors were manipulated by the story and  
 520 photographs that were used to explain the source of the  
 521 fingerprints, for example crimes with no physical harm to  
 522 the person versus crimes with extreme physical harm. The  
 523 study showed that in cases where the fingerprints were  
 524 unambiguously different, there was little effect of context.  
 525 When the fingerprints were ambiguous, namely when the  
 526 certainty as to whether they were the same of different  
 527 decreased, then the contextual factors seemed to play a role  
 528 in increasing the likelihood of seeing a match. However,  
 529 this effect was only observed for the context in which  
 530 extreme physical harm featured in the background story.  
 531 The study suggests that in cases where there might be some  
 532 uncertainty as to whether fingerprints match and where the  
 533 crime is extreme, that matching might be influenced by  
 534 context. This also suggests that while the use of a narrative  
 535 to guide the collection of evidence might be beneficial, it  
 536 can also bias interpretation and, by implication, search.  
 537 This raises the potential (and, perhaps, often unexplored)  
 538 question of how recognition-primed decisions can become  
 539 biasing rather than supporting, particularly in terms of  
 540 expectancy bias. This also highlights the importance of  
 541 maintaining as neutral a description in crime scene reports  
 542 associated with recovered evidence as possible, and shows

why the inductive approach is preferable for the CSE; even 543  
 if the final ‘theory’ to which the evidence leads is not 544  
 developed by the CSE but by other people in the criminal 545  
 justice process. 546

7 Evidence Sharing 547

The preceding discussion implies that the search of a scene 548  
 is guided by experience, expectation and the ability to 549  
 recognise items of evidential value. In this respect, the 550  
 notion of Distributed Cognition can be interpreted in terms 551  
 of the use of objects in the world as resources-for-action. 552  
 The Crime Scene Examiner recognises objects as resour- 553  
 ces-for-action which may well differ from untrained 554  
 observers. For example, while the untrained observer might 555  
 assume that a pane of glass in a window could yield fin- 556  
 germarks, they might be less inclined to immediately 557  
 assume that it could also yield footwear marks, and still 558  
 less inclined to recognise its potential for yielding DNA 559  
 (the latter two could arise from someone climbing in 560  
 through the window, or from pressing their forehead 561  
 against the window to see if anyone is at home). 562

So far, this description looks very much like a process 563  
 that involves the mental states of an individual; the CSE 564  
 interprets the scene, recognising objects as resources-for- 565  
 action, and then recovers the evidence. However, what 566  
 makes the Crime Scene Examination process different 567  
 from a Sherlock Holmes story is that the CSE submits the 568  
 evidence for interpretation by other people. Indeed, it is 569  
 unlikely for the CSE’s notes and reports from the scene to 570  
 include any deduction. Rather the report will be as 571  
 descriptive as possible. This representation, of the scene 572  
 and its evidence, is passed along the recovery train. So we 573  
 have a set of processes that could ostensibly represent the 574  
 stimulus (or input) to a cognitive processing system. This 575  
 processing is (formally) undertaken by people other than 576  
 the CSE. 577

Once evidence has been recovered, it is placed in 578  
 appropriate bags (or containers), labelled and passed on the 579



580 Forensic Laboratory for further analysis. This step in the  
 581 process requires some means of maintaining accurate  
 582 records of who has handled the evidence, as well as the  
 583 accumulation of the results of analyses. This relates to a  
 584 point made earlier, that the 'distributed' nature of the  
 585 Crime Scene Examination process can make this process  
 586 somewhat disjointed, in that it is not uncommon for the  
 587 Forensic Scientist in the laboratory to have very little  
 588 information on the item recovered. One could make a  
 589 strong argument that this lack of information helps an  
 590 analysis to be as objective as possible, by focussing only on  
 591 the item at hand (and avoiding the potential for bias that  
 592 Dror et al. (2005) demonstrated). On the other hand, it  
 593 might be useful to have some knowledge of the item in situ,  
 594 so as to decide how best to conduct analysis. If the Forensic  
 595 Scientist had recovered the item herself then such infor-  
 596 mation would be recalled by her, but when it is delivered in  
 597 a batch of bags then such information is not obviously  
 598 available. As an example of why this could be problematic,  
 599 consider a finger-mark left on a window. This mark might  
 600 not be detailed enough to form a print, but could indicate  
 601 whether the window has been forced up or whether  
 602 someone climbed down the window, knowing the orien-  
 603 tation of the mark on the window can help decide how best  
 604 to analyse it, but this might not have been provided in the  
 605 evidence log.

## 606 8 Reporting and disclosure

607 In previous discussions of Crime Scene Examination,  
 608 Baber et al. (2006a, b) consider the manner in which nar-  
 609 ratives are passed through the evidence chain. The argu-  
 610 ment was that different people in the evidence chain  
 611 develop narratives (both formal and informal) that sum-  
 612 marise the key aspects of their interpretation of the events  
 613 and environment. Thus, a victim or witness might provide  
 614 an account of the events as they recall; although, of course,  
 615 the nature of eye-witness testimony is notoriously contra-  
 616 dictory and prone to error (Wells and Olson 2003). Each  
 617 account would develop a particular narrative, emphasising  
 618 the aspects that the witness feels was relevant, and attempt  
 619 to maintain an internal coherence and consistency (but  
 620 which might differ from other accounts). Interviewing of  
 621 suspects, in part, involves comparing different narratives  
 622 (from the suspect versus a synthesis of the witness state-  
 623 ments which maintains coherence and consistency). In this  
 624 context, the role of forensic evidence becomes merely a  
 625 tool to resolve any ambiguities in these accounts. However,  
 626 of course, forensic evidence has become increasingly sig-  
 627 nificant in investigations (to the extent that it is often given  
 628 priority over narratives because of its assumed objectivity  
 629 in comparison with the obvious subjectivity and potential

for bias in the narratives). We propose that each step in the  
 criminal justice process involves the production of narra-  
 tive. There are the formal narratives that are structured by  
 the reporting procedures and forms that are used to record  
 investigations and analyses. This would lead to a set of  
 reports, from Crime Scene Examiners and Forensic Sci-  
 entists, which are written in a scientific style and which  
 record details in as objective a manner as possible. Such  
 narratives would then be subjected to scrutiny in Court in  
 terms of the methods used to perform the analysis and the  
 interpretation of the results. On the other hand, there are  
 informal narratives that are passed on through discussion  
 with agents involved in the investigation (say, between an  
 attending officer and a victim, or between the attending  
 officer and the crime scene examiner). These tend not to be  
 recorded for several reasons. First, as discussed in the  
 following paragraphs, Laws of Disclosure mean that any-  
 thing which has a bearing on the case needs to be available  
 to both Defence and Prosecution so as to maintain fairness  
 and balance. Second, and perhaps more importantly, much  
 of this informal narrative could be said to involve the  
 development of formal narrative, e.g., an experienced  
 attending officer might speak with a victim to calm or  
 reassure them prior to taking a formal statement, and  
 during this process the victim might have several partial  
 accounts of what has happened but be seeking to reconcile  
 this into a single.

The final decision of the relevance of an item of evi-  
 dence is made in Court during the hearing. However, an  
 initial assessment will be made (in the UK) by the Crown  
 Prosecution Service which will evaluate the evidence that  
 is being presented in support of a case and decide whether  
 it is suitable. This raises one of the key dilemmas in evi-  
 dence recovery and relates to the Laws of Disclosure.  
 Basically, these Laws of Disclosure state that anything that  
 has been collected as part of the investigation can be made  
 available to both Prosecution and Defence (even if it is not  
 presented at Court). This raises two issues for this discus-  
 sion. First, the adversarial nature of the Justice System (in  
 the UK and many other countries) means that the 'Dis-  
 tributed Cognition' involves not only cooperation and  
 collaboration (in terms of several people contributing to a  
 common goal) but also conflict (in terms of two parties  
 attempting to prevent each other from achieving their  
 goal). I am not sure that there are many other areas of  
 distributed cognition research which come up against this  
 problem (although, of course, one can imagine many  
 examples from military and law enforcement). Second, the  
 process often involves a number of different forms of  
 analysis and interpretation. In Baber et al. (2006a, b), we  
 referred to these forms as formal and informal narratives  
 and suggested that there was a continual development of  
 narratives, along several lines, over the course of an

683 investigation and that very often these narratives might not  
684 connect.

## 685 9 Conclusions

686 In this paper, I suggest that, for Crime Scene Examination,  
687 cognition is distributed in three senses. First, there is the  
688 distribution of attention between the activities involved in  
689 searching, recovering and reporting. Second, there is the  
690 distribution of cognition between CSE personnel and the  
691 scene itself; the manner in which the scene is examined  
692 provides hints and cues to what evidence to recover, and  
693 interrupting this process (through the need to complete  
694 lengthy reports) could disrupt this process. For this activity,  
695 the environment and objects it contains become resource-  
696 for-action that the experience and training of Crime Scene  
697 Examiners allow them to interpret in ways which might be  
698 different to that of the untrained observer. Furthermore, the  
699 manner in which recovered items are passed from one  
700 person to the next in the evidence chain can modify the role  
701 of these items as resources-for-action; each step in the  
702 process interprets the information from the previous step in  
703 terms of additional knowledge and information. Third,  
704 there is the distribution of information between CSE per-  
705 sonnel and other people involved in the investigation. The  
706 notion of formal and informal narrative, and their devel-  
707 opment through the criminal justice process, sees these  
708 narratives as additional resources-for-action.

709 A 'weak' view of the Distributed Cognition argument  
710 might claim that what is being distributed is the collection  
711 of objects upon which the act of cognition can be focused.  
712 This would require objects-in-the-world to play a fairly  
713 passive role in the process of cognition and for them to  
714 function as vehicles for the storage or representation of  
715 information. The artefacts allow users to off-load infor-  
716 mation (Scaife and Rogers 1996) and also a record of  
717 previous activity. In this version, the objects have their  
718 states altered by the actions that their users perform on  
719 them (e.g., through note-taking, folding or other markings).  
720 Furthermore, not only do these objects provide a means of  
721 recording and storing information, but their design affords  
722 (or influences) the actions of the person using them.

723 A 'strong' view of Distributed Cognition posits that it is  
724 the tasks involved in cognition which are being distributed.  
725 One way in which the activity of the CSE differs from some  
726 of these domains, is in the initial definition of objects-in-the-  
727 world, and for these objects to be 'revealed' in order to be  
728 recovered. This would regard the role of the CSE is primarily  
729 one of induction, or rather, as one of providing the set of  
730 alternatives upon which a process of induction could be  
731 applied. I would suggest that the act of induction takes place  
732 in the Court (or at least in the Crown Prosecution Service

733 which decides whether a Case can be presented to Court).  
734 Prior to this act of induction, there are initial acts of  
735 deduction which are formally assigned to the Forensic Sci-  
736 entists, in their analysis and interpretation of evidence, but  
737 also informally applied by the CSE in the decision as to  
738 where to look and what to recover. In this view, one would  
739 expect agents and objects-in-the-world to be more active and  
740 capable of either performing, or at least participating in,  
741 information processing tasks. For example, Hutchins  
(1995b) famously speaks about the ways in which the flight-  
742 crew and their instruments work together to monitor the  
743 speed at which an aircraft is flying; his assertion is that this  
744 knowledge does not reside in the head of one specific indi-  
745 vidual, but is derived from the collection of information that  
746 is available in the cockpit. Perhaps, a point to note here is  
747 that, ultimately, there needs to be some 'cognizing entity'  
748 that is capable of combining the various bits of data into a  
749 coherent 'whole' and that this requires a set of mental  
750 capabilities that are uniquely human.  
751

752 Both views raise questions that relate to the manner in  
753 which cognition becomes a matter of sharing tasks. In  
754 terms of distributed cognition, the work reported in this  
755 paper covers both the 'weak' and 'strong' views of dis-  
756 tributed cognition. From the 'weak' view, it is argued that  
757 the training, knowledge and experience of Crime Scene  
758 Examiners allow them to use the environment and the  
759 artefacts within it, together with the collection of narratives  
760 through the criminal justice process, as resources-for-  
761 action in a manner that might be alien to the non-expert. In  
762 this way, the Crime Scene Examiner will not only search  
763 for specific artefacts but also be able to identify locations  
764 which could yield non-visible materials (e.g., places to  
765 check for fingerprints, DNA and other evidence). The use  
766 of eye-tracking and verbal protocol from crime scene  
767 examination shows how the approach to searching a scene  
768 differs with experience. From the 'strong' view, the  
769 reporting and interpretation of evidence from a crime scene  
770 through the criminal justice process implies a collective  
771 activity (which might not be coordinated by a central  
772 agency) that accumulates information to a point at which  
773 its interpretation can be tested in Court. While neither  
774 approach should be taken to imply that mental states are  
775 distributed across individuals, both imply that the action of  
776 one individual will form the basis for actions of the next. In  
777 this manner, the criminal justice process is able to 'know'  
778 the collected evidence, even though it is unlikely that a  
779 single individual will have access to all of the information  
780 collected during the examination.

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