Towards a theory of tagging in retail environments

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Abstract

In this chapter we develop a theory of security tagging. We draw chiefly on the results of a recent systematic review of the tagging literature, supplemented with evidence from other germane areas of crime prevention. Our aim is to construct a theory that applies across varying retail settings and which can therefore be drawn on to improve decisions on the appropriateness of tagging in specific contexts.

On security tagging and the merits of theory

Theft is a common and costly problem for retailers. A recent survey of wholesalers and retailers in England and Wales found that 25 percent had experienced at least one theft in the past year (Williams, 2016). Repeat victimization was common, with victimized businesses experiencing an average of 41 thefts over the same time period. Shoplifting accounted for seventy-two percent (3.3 million incidents) of all crimes committed against members of the wholesale and retail sector. Theft by employees made up just one percent (39,000 incidents).

Theft, by customers or employees, is a major source of "shrinkage", the term used by businesses to denote preventable losses resulting from crime, administrative errors and product damage or wastage (for a detailed discussion see Beck, 2016a). Retailers define shrinkage in different ways, so comparisons between businesses can be misleading (Beck, 2016a). Notwithstanding these disparities, a survey of 203 retailers estimated the annual cost of shrinkage across the 24 participating nations at US$123 billion (Global Retail Theft Barometer, 2015). Eighty-four percent of shrinkage losses were attributed to crime (shoplifting, employee theft and supplier fraud).

In response, retailers have implemented a variety of security measures (see Clarke and Petrossian, 2012), the prevalence of which is rising, in what Hopkins and Gill (2017, p. 379) call the 'securitization of business'. According to the Commercial Victimization Survey, there were substantial increases in the proportion of retailers that employed CCTV (185%), window protection (54%) and burglar alarms (14%) between 1993 and 2013 (Hopkins and Gill, 2017). Security is of course but one consideration for retailers. Decisions over what to do about crime must also take account of the perceptions and experience of customers, costs, aesthetics, environmental effects, reputation, privacy and so on.

This chapter is concerned with security tags. Tags are attached to or inserted in products or packaging with the intention of reducing theft. They are popular among retailers in part because tagged merchandise remains on open display and is thus readily accessible to customers and staff. There are several kinds of security tag (see Beck 2016b). Ink dye tags contain a chamber of indelible ink which is released when a tag is tampered with (DiLonardo

and Clarke, 1996). These tags are non-electronic and typically applied to clothing. Electronic article surveillance (EAS) tags, by contrast, can range from "hard" plastic tags to "soft" paper tags (DiLonardo, 2008; Hayes, 2007). They are installed as part of a system which comprises the electronic tag, detector gates with built-in radio antennae (typically located at store exits) and a control unit. EAS tags are designed to trigger an alarm when passing a detector gate whilst active.

There is a sizeable literature on security tags (see Beck, 2016b; DiLonardo, 2008; Hayes, 2007). Studies emanating mainly from the US have assessed the impact of tags on theft (Bamfield, 1994; Beck and Palmer, 2010; DiLonardo and Clarke, 1997; Hayes and Blackwood, 2006), examined retailers' reasons for and experience of applying tags (Blackwood and Hayes, 2003), and interviewed shoplifters on how they perceive and seek to circumvent security tagging (Hayes, 1997; Gill, Bilby and Turbin, 1999; Lasky, Fisher and Jacques, 2015). There is also a recent systematic review of the tagging literature (Sidebottom et al. 2017a), in which we collaborated and whose findings will be discussed shortly. Yet for all these studies and the insights they contain, to our knowledge there is as yet no theory of tagging in retail environments. This limits the extent to which evidence on tagging can be confidently generalized across settings.

Theory is sometimes given bad press. It is a central currency of academia and by association has received the same criticisms that are customarily leveled at academics: irrelevant, inaccessible and highfalutin. Moreover, theory is often portrayed as something that is distinct from and unrelated to the 'practice' of reducing crime. We find the distinction unhelpful – and inaccurate. Following Tilley and Sidebottom (2017), in this chapter we adopt a Popperian (1972) conception of theory. We take it to mean any set of ideas on which we might act or interpret the world. Thus conceived, platitudinous assumptions that theory is divorced from practice are hard to sustain. On the contrary, we contend that the practice of crime prevention is awash with theory, albeit that such theories are seldom articulated or empirically tested (Tilley and Sidebottom, 2017). The decision to apply any crime prevention measure (for example a security tag) embodies a conjecture that the measure can and will bring about its intended crime prevention outcomes (say reduced levels of theft) in the circumstances in which it is being used (say the particular shop/s in question), without unacceptable negative side effects (for example loss of sales).

To claim that theory is ubiquitous in crime prevention says nothing about the *value* of theory for crime prevention. A critic might therefore ask why we need a theory of tagging. This is why. The notion that decisions on how to deal with crime should be informed by reliable research evidence is now widely both advocated and accepted[1]. Evidence on the effectiveness of an intervention is clearly an important consideration when deciding how best to deal with a presenting problem. But it only goes so far. As Eck (2017a, p. 579) writes, 'accumulating evaluation findings by itself does not teach us much…these are necessary, but ultimately insufficient conditions for learning'. More specifically, they provide limited guidance on arguably the most pressing question for those tasked with reducing crime: whether an intervention that worked 'there' (i.e. produced positive outcomes in specific study settings) will generate the same desired outcomes 'here' (i.e. in the novel setting of interest) (Cartwright, 2013; Eck, 2017a).

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[1] This is not to ignore critiques of so-called "evidence-based policing" as it is generally conceived (see for e.g. Eck, 2017b, Sparrow, 2016; Tilley and Laycock, 2017).

Theory helps generalize from 'there' to 'here'. It does so in several ways. First, theory provides a framework to make sense of research findings, comparing the results of an individual study with those expected on the basis of prior research. Second, theory helps organize knowledge at a higher level of abstraction than the particulars of any specific study or suite of studies, which in turn can be drawn upon when deciding whether an intervention that was effective in one setting stands a good chance of being effective elsewhere. Third, theory can assist evaluation design. Specification of the mechanisms through which an intervention is hypothesised to reduce crime in the context in which it is to be introduced allows detailed predictions of outcomes patterns to be derived. Then, provisions for relevant data collection and analysis can be made that speak to those patterns (for example where, when and which crimes are expected to fall, in comparison to crime types where falls would not be expected). Fourth, studies that test intervention theories provide for cumulation. Findings from one study lead to applications in another context, thereby clarifying the limits to the generalisability of findings and informing refinements to the theory. This then provides for better-informed targeting of interventions in the future.

To illustrate the value of theory with a practical example, consider hot spots policing. There is strong evidence from primary studies (Ratcliffe, Taniguchi, Groff and Wood, 2011) and meta-analyses (Braga, Papachristos and Hureau, 2014) that police patrols targeted at geographic micro-places where crime concentrates have been associated with significant reductions in crime. There is also some consensus on *how* targeted police patrols reduce crime, with most commentators invoking deterrence both in the immediate time and place in which police officers are present (initial deterrence) and in the targeted area for a period of time post-patrol (residual deterrence). However, as Sherman et al. (2013) observe, despite a large body of evidence on the *effects* of hot spots policing, only recently has a theory emerged on *how to implement* hot spots policing so as to maximise the probability of achieving the sought-after preventive gains. Sherman et al. (2013) go on to propose a ten-point theory of hot spots policing which in turn informed a hot spots policing trial in Trinidad and Tobago. This chapter seeks to do for security tagging what Sherman and his co-authors have done for hot spots policing.

Our chapter proceeds as follows. In the next section we summarise the methods and main findings of a recent systematic review of the tagging literature. The approach taken in this review departs from the standard model of systematic reviews in crime prevention. More specifically, evidence was synthesised on not only the effects of tagging but also its mechanisms, moderators, implementation and economics, guided by the EMMIE framework (Johnson, Tilley and Bowers, 2015). It is our view that this type of review lends itself to the development of programme theories, which we attempt later in this chapter through the use of a logic model. We finish with a brief discussion of the implications of our theory for crime prevention.

EMMIE and the evidence on security tagging

At root, evidence-based crime prevention is about ensuring that those with the responsibility and competency to deal effectively with crime possess relevant and reliable evidence with which to make informed decisions. This raises the question: what types of evidence do decision makers need? Johnson, Tilley and Bowers (2015) proposed the acronym EMMIE to highlight five categories of evidence relevant to crime prevention. The initial E refers to the 'effects' of an intervention. This is the dominant outcome measure in evaluations and

systematic reviews in crime prevention. The next two elements of EMMIE originate in the scientific realist approach to evaluation (Pawson and Tilley, 1997), and the guiding conviction that 'outcomes unearthed in empirical investigation are intelligible only if we understand the underlying *mechanisms* which give rise to them and the *contexts* which sustain them' (Pawson and Tilley, 1996, p. 574). Consistent with this perspective, the first M of EMMIE refers to 'mechanism', the causal processes by which an intervention produces its effects. Mechanisms matter because a single intervention can lead to reductions in crime in multiple ways (see for example Tilley, 1993 on CCTV and Sidebottom et al. 2017b on alley gating). Evaluations should therefore collect data on the outcomes expected if hypothesised mechanism(s) are at play, what Eck and Madensen (2009) call 'signature analysis' (see also Farrell, Tseloni and Tilley, 2016). If the outcome patterns are consistent with expectations then we can be more confident in attributing the observed effects to the intervention. But mechanisms are seldom activated unconditionally. They require favourable conditions. This is what realists call 'context', represented in EMMIE's second M as 'moderators'. This refers to the conditions that are necessary for a mechanism(s) to generate the desired outcome[2]. The I of EMMIE refers to 'implementation' – the practical task of *doing* crime prevention, and a common source of intervention failure (Ekblom, 2010; Homel and Homel, 2012). And finally, the second E denotes 'economics', referring to the cost-effectiveness of an intervention.

Johnson et al. (2015) proposed EMMIE as a framework to assess the type and quality of evidence in systematic reviews in crime prevention. EMMIE also has a prospective function, however, through supporting the design and conduct of new systematic reviews in the hope of increasing their policy relevance. EMMIE was applied this way in the systematic review of security tagging through the use of a mixed-methods approach. Further details on these methods can be found in Sidebottom et al. (2017a; 2017b). In the remainder of this section we limit our discussion to the key findings from the review on tagging, which are summarised in Table 1.

Sidebottom and colleagues (2017a) identified fifty studies judged eligible for inclusion in the review. Of those, eight studies contained quantitative data on the effectiveness of tags. The risk of bias among these eight studies was considered medium to high. A particular concern related to the (non-)comparability of action and control groups since none of the identified evaluations performed statistical tests to ensure equivalence before tags were installed. On extracting data from these eight studies, it was evident that despite a shared concern with assessing the impact of tags, there was substantial heterogeneity between studies both in terms of tag type (for example conspicuous vs. visible tags) and outcome measure (for example shrinkage, shortage, theft, and sales). In light of this diversity, a meta-analysis was deemed inappropriate. In the absence of a single estimate on the effectiveness of tags, and mindful of the limitations of "vote counting", Sidebottom et al. (2017a) report that five of the eight evaluations showed positive benefits (broadly defined) associated with the installation of tags, with more visible tags tending to be more effective than less visible tags. One study reported no effect of tags and the remaining two studies showed *increases* in shrinkage (a backfire effect). It is also noteworthy that despite retailer accounts of tagged items conferring protection to non-tagged items, no studies were found that analysed displacement/diffusions of benefits following the use of security tags.

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[2] The term 'moderator' is used here to refer to conditions for the activation of causal mechanisms rather than to any variable that may 'moderate' effects otherwise found, for example as a result of study design.

Turning to the other elements of EMMIE, twenty-seven studies contained information on the mechanisms thought to underpin tagging effectiveness. These mechanisms were generally consistent with the language of rational choice and situational crime prevention. For example, the most frequently cited mechanism associated with tags was *increase the risk*. The assumption was that tags reduce opportunities for theft by increasing the probability, perceived or actual, that offenders will be detected when attempting to leave a store with a tagged item. The second most commonly referred to mechanism related to *reductions in rewards*. This was typically invoked when discussing the operation of ink dye tags, whereby attempts to remove tags might cause them to break thereby spoiling the tagged merchandise and reducing its desirability and resale potential. The third mechanism concerned *increasing the effort*. Whether an item is stolen for use or sale, attached tags need to be removed, either in store or after the event. Consequently, all things being equal, the effort required to successfully steal and dispose of tagged merchandise will be greater than that for non-tagged items. Some individuals liable to steal merchandise will be deterred by the increased effort.

Twenty-eight studies contained information on the environmental conditions associated with security tags being more or less effective. Five key 'moderators' were identified (albeit that the term was rarely used). The first relates to store and staff. For example, the design of stores can determine the ease with which suspected offenders can be monitored or the speed with which staff can respond to sounding alarms. The second moderator relates to the type of tag(s) and how they have been applied. For example, in some stores a sufficient level of deterrence might be achieved by selectively tagging only a small proportion of items (known as fractional tagging). Elsewhere blanket coverage may be preferable. The third contextual feature shaping the potential for tag effectiveness concerns the type and mix of merchandise. For example, some products are more amenable to tagging than others (i.e. small cosmetic items are tricky to tag); some are better suited to certain types of tags (i.e. meat products are better suited to soft tags). The fourth moderator relates to the actions of the police and criminal justice system. Simply put, retailers' efforts to deter, detect and detain shoplifters are affected by the speed of police response, and the likelihood that apprehended offenders will be arrested, prosecuted, and convicted.

The final moderator concerns the types of customers that visit a store, including those liable to respond to crime opportunities and temptations. There are numerous motives thought to explain shoplifting, from the acquisition of resources to theft as a form of excitement or a response to peer pressure (Walsh, 1978). Despite this variation in motive, the literature on retail crime suggests two types of offender involved in shoplifting. Frequent, professional shoplifters are widely distinguished, with some research evidence, from occasional, amateur, opportunist ones. Opportunist shoplifters are considered open to temptation, but do not go to shops with the intention of stealing. Professional shoplifters, by contrast, go to shops in order to steal and generally do so to sell the items stolen or to exchange them for drugs. It is assumed that preventing theft by the former is simpler than preventing theft by the latter – the former are more easily put off (by, say, overt preventive measures), while the latter have a strong interest in testing and overcoming security measures, including tags, that are put in place to protect the type of goods they wish to steal.

The distinction between 'moderators' and 'implementation' is imperfect. Much of what is done in the name of implementation might affect the activation of causal mechanisms, our definition of a moderator. By contrast, much of what might plausibly affect the activation of causal mechanisms has little to do with implementation. Despite this overlap, two distinct areas of implementation were identified by Sidebottom et al. (2017a). The first related to

store staff. The literature on tagging included numerous references to staff incorrectly attaching, removing and/or deactivating tags, and in the case of EAS tags failing to respond to sounding alarms (around one in five according to Hayes and Blackwood (2006). Training, monitoring and incentives were deemed necessary to improve staff participation in a tagging initiative. The second factor relevant to implementation concerns the ways in which tags are fitted. Retailers may opt to use one type of tag or alternatively deploy a range of tag types, including decoy tags (those that are inoperative). As alluded to already, they may opt for blanket coverage or apply tags selectively to those items considered most susceptible to theft and/or those with the highest profit margin. Tags can also either be applied at source by the manufacturer or in store by the retailer (see Beck, 2016a). Decisions over the best strategy to adopt will depend on the resources available to and merchandise stocked by the retailer.

The final area of synthesis concerned economics. Estimates on the cost of tags were found to vary widely, reflecting the heterogeneity in tagging initiatives. Although several studies were identified which detailed the various costs of tagging (the tag, associated infrastructure, staff costs of applying and removing tags, etc), comprehensive cost-benefit analyses were lacking. Retailer reports made available to the review authors did investigate the effect of tags on sales figures. Downs et al. (2011), for example, showed how the use of a highly visible EAS tag led to both reductions in shrinkage and an uptick in sales. Theft and sales rates do not always operate in tandem, however. Our review turned up one retailer report which described a switch from secure casings on DVDS to the use of soft EAS tags. In reviewing the effects of this change, it was reported that stores knowingly accepted increased thefts of untagged DVDs on the grounds that it gained more from being able readily to display the tagged DVDs and thereby sell more.

<INSERT TABLE 1 ABOUT HERE>

Building theory

We began this chapter by advocating the importance of theory for crime prevention. We argued that theory plays an essential role in organising knowledge. This in turn can profitably inform and accelerate decisions as to whether and how an intervention shown to work in one setting might produce the same effects elsewhere. Next, we provided an overview of what we know about security tagging based on a review of the available evidence, structured according to the EMMIE framework. In this section, we attempt to bring these two themes together. We take the key findings from Sidebottom et al.'s (2017a) systematic review of tagging and in combination with evidence from cognate areas of crime prevention and environmental criminology more generally (see Wortley and Townsley, 2016), work up a theory of tagging in retail environments.

Developing theory can be challenging, however. Tilley and Sidebottom (2017) list several sources of complexity in crime prevention that pose difficulties for the development of theory. These include the multitude of proximal and distal factors implicated in crime causation, the shifting backdrop of social, technological and economic changes against which crime and its prevention play out, and the equally dynamic interplay between innovative offenders and crime preventers. What holds for crime prevention in general is also true of security tagging in particular. Whilst tags look at first sight to be a rather straightforward crime prevention device, the application of EMMIE showed that despite appearances, tagging is both theoretically and practically complex.

This complexity is amplified further by the processes of innovation and mutual adaptation that characterise shoplifting and its prevention (Lasky et al. 2015; for a general discussion see Ekblom, 1999). Shoplifters steal; merchants install preventive measures; professional shoplifters adapt to circumvent the measures; circumvention techniques are then disseminated, both in person and (increasingly) online; shop staff adapt to changes in the frequency of alarms and the reactions of those activating them; merchants adapt by installing new measures some supplementary and some complementary and by issuing new instructions to staff; suppliers of tags devise improved products intended to catch up with or get ahead of innovative offenders; professional shoplifters adapt again; etc. At the same time, new and highly desirable products are developed for which there is a flourishing stolen goods market, 'crime harvests' ensue (Pease, 2001), meanwhile older products become too cheap and too undesirable to warrant offender attention. Police attendance to shoplifting incidents also changes according to resource availability and expectation that they will be able to make an arrest that will lead to conviction. Merchants similarly adapt to police practices in their decisions over whether to detain suspected shoplifters. And so on.

These layers of complexity present challenges for the study of retail tagging. Research cannot hope separately to examine all permutations of the heterogeneous conditions for tags. Moreover, the complexity at work in retail tagging means that any particular application of tags will occur in a distinctive configuration of conditions that are liable to influence the causal mechanisms activated by tags and the outcomes produced from them. This poses obvious problems for those asking themselves whether a tagging regime that produced positive effects in one setting will generate the same outcomes elsewhere. One way of attempting to deal with this complexity is to consider tagging at a higher level of abstraction and develop what Merton (1967) popularised as *middle-range* theory. In the context of security tagging, such theory would sit somewhere between the range of findings emanating from retail research and experience and grand theories of how crime is caused and patterned. Such a theory would not be tied to any particular tag, retailer or setting, but instead would strive to consolidate the available evidence into a generalizable framework to help identify the types of tagging strategy that work for particular types of products in particular retail settings.

For the purposes of this chapter we have opted to use a logic model to present our theory. Logic models are a schematic commonly employed by planners and evaluators to chart how a given programme is expected to work under different conditions. McLaughlin and Jordan (1999, p.3) add that logic models help identify 'key performance measurement points and evaluation issues [that] improves data collection and usefulness'. Moreover, they usefully 'facilitate communication amongst program planners, evaluators, and a range of stakeholders by making assumptions upon which programs are predicated more transparent and causal mechanisms more explicit' (Anderson and colleagues, 2011, p. 34).

Our logic model for tagging in retail environments is presented in Figure 1. It should be interpreted as comprising four columns. Taken together these four columns depict a casual sequence running from left to right, albeit in reality there are various feedback loops that buck this linear trend, which we will discuss shortly. The first column (intervention) highlights some key considerations when deciding on a tagging initiative. We have divided this panel into two parts: decisions that relate to the tag (i.e. ink or EAS tag, hard or soft tag, etc.) and decisions that relate to how tags are deployed (i.e. tag all or some products, tag at source or in-store). The second column (mechanism) refers to the causal processes through which tags are expected to lead to the sought-after outcomes. Although these are listed singly

in Figure 1 (i.e. risk, effort, reward), tags might plausibly activate multiple mechanisms simultaneously. Columns three and four detail intermediate and ultimate outcomes that might be generated by the activation of said mechanisms. For our purposes, intermediate outcomes refer to those shorter-term changes that are directly linked to the installation of tags and which individually or jointly contribute to the ultimate outcomes. It is worth mentioning at this point that columns three and four include both positive and negative effects, reflecting the mixed results reported in Sidebottom et al. (2017s). Moreover, these outcome measures are not limited to crime but include sales rates and customer experience, again reflecting the broader concerns of retailers.

<INSERT FIGURE 1 ABOUT HERE>

Bridging the four columns of Figure 1 is a panel that indicates some of the key contextual factors assumed to moderate the activation of tagging mechanisms. We have organised these factors according to the extent to which they might plausibly be modified by retailers (and related parties). Those factors towards the left-hand side are generally more amenable to modification than those towards the right. For example, store design and layout will influence the extent and distribution of crime opportunities. Attractive items without adequate security provisions that are displayed within easy reach of potential offenders are, all things being equal, more likely to be stolen than equivalent items that are less accessible. We can assume with some confidence that retailers have a strong say in these decisions. By contrast, issues regarding the police response to shoplifting or the extent, type and motivation of those liable to steal from shops is largely (though not completely) outside of retailers' control.

Concentrating now on these contextual factors, we have already discussed how the actions of staff are an important moderator of tag effectiveness. Focussing specifically on how staff behaviour might influence the activation of tag mechanisms, consider the case of EAS tags. The literature is clear in showing that many alarms do not initiate a staff response. Hayes and Blackwood (2006) found that only 18% of some 4,000 sounding alarms were acted on by store staff. Some of these alarms will inevitably be false, the product of tags not being removed, untagged items still triggering the alarm or because of a malfunctioning system. Whatever the reasons, so-called 'alarm apathy' is common. Yet from the perspective of the offender, failure to consistently respond to sounding alarms communicates the message that the probability of being confronted when attempting to exit a store with a tagged item is far from inevitable, thereby undermining the risk elevation mechanism assumed to underpin the effectiveness of EAS tags. We might therefore speculate that, all things equal, greater levels of alarm apathy will be associated with higher levels of shop theft.

The type and diversity of products can likewise moderate tag mechanisms through, say, influencing the kind of tag that might plausibly be deployed or the extent to which a given store is considered an attractive target for theft. Regarding the latter, there is strong theoretical and empirical support that theft is unevenly distributed across product lines. Popular targets for theft tend to be those that are CRAVED (concealable, removable, available, valuable, enjoyable and disposable, see Clark, 1999) and, focussing specifically on consumer goods stolen for resale, those that are affordable, transportable, concealable, untraceable, tradeable, profitable, reputable, imperishable, consumable, evaluable, and shiftable, represented by the acronym AT CUT PRICES (Gill and Clarke, 2012). Analysing theft data for over 7,000 products stocked in 204 US supermarkets, Smith (2017) recently showed that items displaying attributes that matched CRAVED were reliably stolen in greater numbers. At a higher level of abstraction, we might therefore infer that *between* stores, those

with a greater proportion of CRAVED items are more likely to be targeted by offenders, and *within* stores, across product lines theft is expected to concentrate on those items that best adhere to the CRAVED model.

No theory nor logic model can hope to capture all the contextual factors that might influence intervention effectiveness. Nor will these factors be of equal salience to all retailers at all times. Figure 1 does not therefore present an exhaustive list of tag moderators but rather a selection of those factors that the literature suggests affect tagging and which retailers should consider. The final contextual factor included in Figure 1 - other prevention measures - received little attention in the review by Sidebottom et al. (2017a) but nevertheless might plausibly influence the operation of tags, based on what we know about crime prevention more generally. Retailers typically employ a range of security measures operating simultaneously. It is possible that in certain conditions the use of other interventions might boost the effectiveness of tags, such as the presence of publicity alerting would-be offenders that tags are in operation. This is not guaranteed, however, and there are examples in crime prevention where more does not mean merrier. One example is the study by Tilley et al. (2015) in which analysis of British Crime Survey data revealed, unexpectedly, that the effectiveness of alarms when installed alongside other burglary prevention measures has diminished over time and may even *increase* the risk of victimization, for reasons suggested by the authors. Return to tagging, we are unaware of any studies that have systematically assessed whether security tags implemented in the presence or absence of other preventive measures are associated with variations in levels of retail theft. Absent such evidence, we might cautiously conclude that the effects of tags might be influenced by additional prevention measures operating in a retail environment and that different configurations of such measures might give rise to different, both intended and unintended, outcome patterns.

Figure 1 depicts two causal pathways. The first pathway (Mechanism A) describes the intended model of how tags might work. Here, we assume that the conditions are sufficient to activate the preventive mechanisms through which tags are expected to work (i.e. risk, effort, reward). If activated, we would expect to see increases in the rates of true alarms and offender apprehension (in the case of EAS tags). Shifts towards a greater ratio of true to false alarms and increases in the number of offenders detected will in turn affect, say, the perceived risk of apprehension among other potential offenders. This feedback loop is depicted in the two-way arrows between columns two and three. As alluded to above, positive intermediate outcome patterns would be expected to lead to reductions in theft and, potentially, increases in sales and diffusions of benefits to other untagged products. We emphasise the word potentially: reductions in theft resulting from an effective tagging initiative is not the only determinant of sales, nor will reductions in the theft of tagged products inevitably lead to reductions in the theft of untagged products. However, in the interests of advancing our knowledge of tagging, these are plausible outcomes associated with tags and should therefore be considered in future evaluations of tagging schemes.

The causal pathway of Mechanism B shows what might happen when tags do not operate as expected. Here, we present an example where offenders have successfully outwitted a tagging scheme and shared the means to do so. In this scenario, we would expect to see increases in, say, the number of discarded tags found in store. We would also expect to observe no impact on theft levels or associated ultimate outcome measures. Mechanism B also covers cases where tags are not removed by cashiers and the customer is hence liable to become dissatisfied because they have either to try to remove the tag and risk spoiling it or return the item to the store or, at worst, are stopped at the store exit and accused of theft when the alarm sounds. Here the unintended outcome relates not to theft but to customer dissatisfaction and

thence inclination to shop again at the same store. False alarms may also feedback to staff reluctance to stop those who set off alarms on leaving the shop, reducing their actual or perceived risk increasing functions as shown in Mechanisms A.

Conclusion and implications

Tags are a popular kind of security measure designed to reduce shoplifting, despite limited evidence on their impact and on the conditions in which they are found to be more or less effective. In this chapter, we set out the beginnings of a theory of tagging in retail environments. We presented our theory with a view to: a) helping retailers think through the relevant considerations in deciding whether to use tags, what types of tags to use, what products to tag, what management arrangements are needed for tags to produce positive but not negative outcomes, and what complementary measures may be most useful, b) informing monitoring arrangements to help track how tags are or are not working, c) stimulating further research on tagging to refine our understanding of their potential as a shop theft reduction measure, and d) sensitising those developing new tagging technologies to considerations that need to go into their design.

A key message of Figure 1 (and crime prevention more generally) is that the same tagging initiative introduced into more or less favourable contexts can activate mechanisms that give rise to different outcome patterns, both intended and unintended. Strictly speaking, each retail store furnishes a unique setting. Even in a chain where other features remain the same, the staff and customer profile will differ. Each outlet will therefore experience its own particular patterns of shop theft. Successful preventive strategies therefore depend on a good enough grasp of a) the circumstances of the store and its pattern of shop-thefts, and b) the potential of the measures being contemplated to reduce the problem sufficiently to cover the costs incurred and any unintended negative side-effects. The theory represented in Figure 1, which is rooted in the available research and environmental criminology more generally, is thus intended to alert decision-makers to the considerations needed to work out whether tagging makes sense for them and what types of tagging strategy to adopt. Ideally, decision-makers or their advisors would populate the boxes with the particulars of their store to work through what could reasonably be expected. Having populated Figure 1 with relevant specifics, the next step would be to monitor the process using relevant data. Such an exercise would be especially useful for large retail chains, where even though individual stores are strictly unique there are many commonalities. In this case, carefully monitored pilots in a few stores would help determine whether tagging is proving cost-effective in the short to medium term and the conditions needed for this to be the case. For researchers working alongside retailers, what such an approach offers is a way of refining our understanding of tagging and its consequences. Retailers could then better be advised on the factors they need to consider in deciding whether to implement tagging and if so how to apply it.

We would hope that our theory is also relevant to the designers of tags who have an interest in selling their products. They face (we hope) increasingly smart customers for tags and (we regret) some smart shoplifters trying to circumvent them. Understanding the uses and abuses of tagging, the ways in which tags produce their outcomes, and the conditions in which patterns of positive and negative outcomes are generated should help tag manufacturers improve the tags they develop.

We began this chapter by claiming that the use of theory in crime prevention is inevitable and ubiquitous. Our argument here is that being explicit about theory is important so that the

grounds for decisions are spelt out and thereby open to discussion in advance and the underlying hypotheses open to test once tagging has been put in place. This is how we can learn from experience. What we have done in this chapter is to take the disparate research available so far relating to tagging and organise it into a coherent theoretical framework, depicted as a logic model, that sits at a sufficiently high level of abstraction to be applicable across a wide range of retail settings. Further work is of course needed to check the completeness and validity of our model, with refinements made in the light of emerging evidence and practice. For now, however, it is our hope that this framework forms a platform for further research and decision-making to inform improvements better and more cost-effectively to reduce shop theft in the future.

References

Anderson, L. M., Petticrew, M., Rehfuess, E., Armstrong, R., Ueffing, E., Baker, P. and Tugwell, P. (2011). Using logic models to capture complexity in systematic reviews. *Research synthesis methods*, *2*(1), 33-42.

Bamfield, J. (1994). Electronic article surveillance: Management learning in curbing theft. In M. Gill (eds), *Crime at work: Studies in security and crime prevention,* pp. 155-173. Leicester, England: Perpetuity Press.

Beck, A. (2016a). *Beyond Shrinkage: Introducing Total Retail Loss*. Retail Industry Leaders Association Report.

Beck, A. (2016b). *Amplifying Risk in Retail Stores: The evidence to date on making shop thieves think twice*. ECR Community Shrinkage & On-shelf Availability Group.

Beck, A. and Palmer, W. (2010). The Importance of Visual Situational Cues and Difficulty of Removal in Creating Deterrence: The Limitations of Electronic Article Surveillance Source Tagging in the Retail Environment. *Journal of Applied Security Research*, 6, 110–123.

Braga, A. A., Papachristos, A. V. and Hureau, D. M. (2014). The effects of hot spots policing on crime: An updated systematic review and meta-analysis. *Justice Quarterly*, *31*(4), 633-663.

Cartwright, N. (2013). Knowing what we are talking about: why evidence doesn't always travel. *Evidence & Policy: A Journal of Research, Debate and Practice*, *9*(1), 97-112.

Clarke, R. V. G. (1999). *Hot products: Understanding, anticipating and reducing demand for stolen goods* (Vol. 112). Home Office, Policing and Reducing Crime Unit, Research, Development and Statistics Directorate.

Clarke, R. V. and Petrossian, G. (2012). The Problem of shoplifting. *Center for Problem-Oriented Policing*.

DiLonardo, R. (2008). Electronic Article Surveillance. In C. A. Sennewald and J.H. Christman (eds), *Retail crime, security, and loss prevention: an encyclopedic reference*. Butterworth-Heinemann.

DiLonardo, R. and Clarke, R. (1996). Reducing the Rewards of Shoplifting: An Evaluation of ink tags. *Security Journal*, 7, 11-14.

Eck, J.E. (2017a) Evaluation and review for lesson learning. In N. Tilley and A. Sidebottom (eds), *Handbook of crime prevention and community safety*, 2nd edition, pp. 560-583. Abingdon, Oxon: Routledge.

Eck, J. E. (2017b). Some solutions to the evidence-based crime prevention problem. In K. Knutsson and L. Tompson (eds), *Advances in Evidence-Based Policing*, pp. 45 – 63. Abingdon, Oxon: Routledge.

Eck, J. E. and Madensen, T. (2009). Using Signatures of Opportunity Structures to Examine Mechanisms in Crime Prevention Evaluations. In J. Knutsson and N. Tilley (eds) *Evaluating Crime Reduction Initiatives*, pp. 59-84.

Ekblom, P. (2010). *Crime prevention, security and community safety using the 5Is framework*. Springer.

Ekblom, P. (1999). Can we make crime prevention adaptive by learning from other evolutionary struggles? *Studies on crime and crime prevention*, *8*, 27-51.

Farrell, G., Tseloni, A., & Tilley, N. (2016). Signature dish: Triangulation from data signatures to examine the role of security in falling crime. *Methodological Innovations*, *9*, 2059799115622754.

Gill, M. and Clarke, R.V. (2012). Differential theft risks of fast moving consumer goods. In P. Ekblom (eds), *Design against crime: crime proofing everyday products*. Crime Prevention Studies, pp. 229-238. Boulder, Co: Rienner.

Gill, M., Bilby, C. and Turbin, V. (1999). Retail security: Understanding what deters shop thieves. *Journal of Security Administration, 22(1), 29.*

Global Retail Theft Barometer (2015). *Global Retail Theft Barometer*. Thorofare, NJ: Checkpoint Systems Inc.

Guerette, R. T. and Bowers, K. (2009). Assessing the extent of crime displacement and diffusion of benefit: A systematic review of situational crime prevention evaluations. *Criminology*, 47(4) 1331-1368.

Hayes, R. (1997). Shop theft: an analysis of apprehended shoplifters. *Security Journal*, 7(1), 11-14.

Hayes, R. (2007). *Electronic Article Surveillance: Reviewing the Failures and Successes of a Shoplifting Control Process*. Report produced by the Loss Prevention Research Council.

Hayes, R. and Blackwood, R. (2006). Evaluating the Effects of EAS on Product Sales and Loss: Results of a Large-Scale Field Experiment. *Security Journal*, 19, 262-276.

Homel, R. and Homel, P. (2012). Implementing crime prevention: Good governance and a science of implementation. *The Oxford handbook of crime prevention*, 423-445.

Hopkins, M. and Gill, M. (2017). Business, crime and crime prevention: emerging debates and future challenges. In N. Tilley and A. Sidebottom (eds), *Handbook of crime prevention and community safety*, 2nd edition, pp. 373-393. Abingdon, Oxon: Routledge.

Johnson, S. D., Tilley, N. and Bowers, K. J. (2015). Introducing EMMIE: an evidence rating scale to encourage mixed-method crime prevention synthesis reviews. *Journal of Experimental Criminology*, *11*(3), 459-473.

Lasky, N. V., Fisher, B. S. and Jacques, S. (2015). 'Thinking thief' in the crime prevention arms race: Lessons learned from shoplifters. *Security Journal*. Doi: 10.1057/sj.2015.21. Accessed 12 June 2017.

McLaughlin, J. A. and Jordan, G. B. (1999). Logic models: a tool for telling your programs performance story. *Evaluation and program planning*, *22*(1), 65-72.

Merton, R.K. (1967). *On theoretical sociology*. New York: Free Press.

Pawson, R. and Tilley, N. (1997). *Realistic Evaluation*. London, UK: Sage.

Pawson, R. and Tilley, N. (1994). What works in evaluation research?. *British journal of Criminology*, *34*(3), 291-306.

Pease, K. (2001). *Cracking Crime Through Design*. London: Design Council.

Popper, K. (1972). *Objective knowledge*. Oxford: Clarendon Press.

Ratcliffe, J. H., Taniguchi, T., Groff, E. R. and Wood, J. D. (2011). The Philadelphia foot patrol experiment: a randomized controlled trial of police patrol effectiveness in violent crime hotspots. *Criminology*, *49*(3), 795-831.

Sherman, L. W., Williams, S., Ariel, B., Strang, L. R., Wain, N., Slothower, M. and Norton, A. (2014). An integrated theory of hot spots patrol strategy: implementing prevention by scaling up and feeding back. *Journal of Contemporary Criminal Justice*, *30*(2), 95-122.

Sidebottom, A., Thornton, A., Tompson, L., Belur, J., Tilley, N. and Bowers, K. (2017a). A systematic review of tagging as a method to reduce theft in retail environments. *Crime Science*, *6*(1), 7.

Sidebottom, A., Tompson, L., Thornton, A., Bullock, K., Tilley, N., Bowers, K. and Johnson, S. D. (2017b). Gating alleys to reduce crime: A meta-analysis and realist synthesis. *Justice Quarterly*, 1-32.

Smith, B. T. (2017). Understanding shoplifting of fast-moving consumer goods: an application of the CRAVED model. *Security Journal*, 1-23.

Sparrow, M. (2016). *Handcuffed: What Holds Policing Back, and the Keys to Reform*. Brookings Institution Press.

Tilley, N. (1993). *Understanding car parks, crime, and CCTV: evaluation lessons from safer cities*. London: Home Office Police Department.

Tilley, N, and Laycock G. (2017). The why, what, when and how of evidence-based policing. In K. Knutsson and L. Tompson (eds), *Advances in Evidence-Based Policing*, pp. 10-26. Abingdon, Oxon: Routledge.

Tilley, N. and Sidebottom, A. (2017). Theory for crime prevention. In N. Tilley and A. Sidebottom (eds), *Handbook of crime prevention and community safety*, 2nd edition, pp. 3-21. Abingdon, Oxon: Routledge.

Tilley, N., Thompson, R., Farrell, G., Grove, L. and Tseloni, A. (2015). Do burglar alarms increase burglary risk? A counter-intuitive finding and possible explanations. *Crime Prevention and Community Safety*, *17*(1), 1-19.

Welsh, D.P. (1978). *Shoplifting: Controlling a major crime*. London and Basingstoke: The Macmillan Press ltd.

Williams, L. (eds) (2016). *Crime against business: Findings from the 2015 Commercial Vicrtimisation Survey*. Home Office: London.

Wortley, R. K., & Townsley, M. (Eds.). (2016). *Environmental criminology and crime analysis* (Vol. 18). Taylor & Francis.

	Studies used (total n = 50)	Key findings
Effect	8	▪ Heterogeneity between studies in tag type and outcome measure precluded a meta-analysis ▪ Five studies reported positive effects associated with tagging; one study reported no effect; two studies reported backfire effects ▪ Conspicuous tags were associated with greater preventive gains than less visible tags ▪ Crime displacement and diffusion of benefits (or halo-effects) was referred to but not empirically examined
Mechanism	27	▪ No studies presented a *quantitative assessment* of tag-related mechanisms ▪ Risk elevation was the dominant mechanism through which tags were deemed to work, particularly for EAS tags ▪ Risk elevation was assumed to operate either by altering perceptions of risk or the actual probability of detection ▪ Reward reduction (or benefit denial) was frequently invoked mainly in relation to ink tags ▪ Increasing the effort was a third albeit less frequently acknowledged mechanism, assumed to work by boosting the effort required to exit a store undetected and/or to detach tags in-store or post theft
Moderator	28	Factors believed to influence tag effectiveness relate to: ▪ *The shop and its staff* – high false alarm rates generate 'alarm apathy' among staff and reduce the likelihood of a swift response thereby weakening the perceived deterrent value to shoplifters ▪ *Tag type and strategy* –whether tags are applied to all or some products may influence offender awareness of tags. ▪ *Merchandise* – the type of product dictates the type of tag that is suitable ▪ *Police* – The arrest and conviction of apprehended shoplifters, and any consequently general deterrent effects, is dependent on the actions of criminal justice agencies. Detaining suspects can be costly and dangerous to the retailer, and so speed of police response is important ▪ *Customers including shoplifters* – occasional, opportunist shoplifters are thought to be more likely to be put off by overt, highly conspicuous tags whereas professional shoplifters, who are more likely to adapt and seek to circumvent tagging measures, covert tags are considered more effective as a means of producing arrests of shoplifters who are unaware of the risks they are taking
Implementation	29	▪ Challenges with tagging were often attributable to the actions of staff, most notably failure to correctly attach, remove or deactivate tags, or respond to sounding alarms. Staff training and monitoring was considered important to

		mitigate these problems.
Economics	32	▪ There were no high-quality cost-benefit analyses of tagging in retail environments ▪ The cost of tags was found to vary widely across studies ▪ The costs associated with tagging relate to more than the tag and associated infrastructure, but also include the costs of hiring staff to attach, remove and monitor tags. These costs are keenly observed by retailers. ▪ Considerations over the effectiveness of tags concern sales as well as loss reduction. Cases were observed where increases in theft (a negative result) were offset by increases in sales (a positive result)

Table 1. Summary of main findings of EMMIE-informed systematic review of tagging

INTERVENTION	MECHANISMS A	INTERMEDIATE OUTCOMES A	ULTIMATE OUTCOMES
Tag properties	▪ Risk elevation		
▪ Type of tag	▪ Effort elevation	▪ True alarms	▪ Theft change
▪ Tag visibility	▪ Reward reduction	▪ Offender detection/arrest	▪ Shrinkage change
			▪ Sales change
Tagging strategy			▪ Displacement
▪ Fixture point (source vs in-store)	**MECHANISMS B**	**INTERMEDIATE OUTCOMES B**	▪ Diffusion of benefits
▪ Dosage (fractional vs blanket)	▪ Offender adaptation	▪ False alarms	
▪ Diversity (single vs multiple tag types)	▪ Diffusion of offender adaptation	▪ Offender success	
	▪ Customer grief	▪ Damaged tags	
	▪ Staff adaptation	▪ Damaged goods	

CONTEXT: Store design and location – Other preventive measures - Merchandise type and mix – Staff – Police response – Shoplifter profile
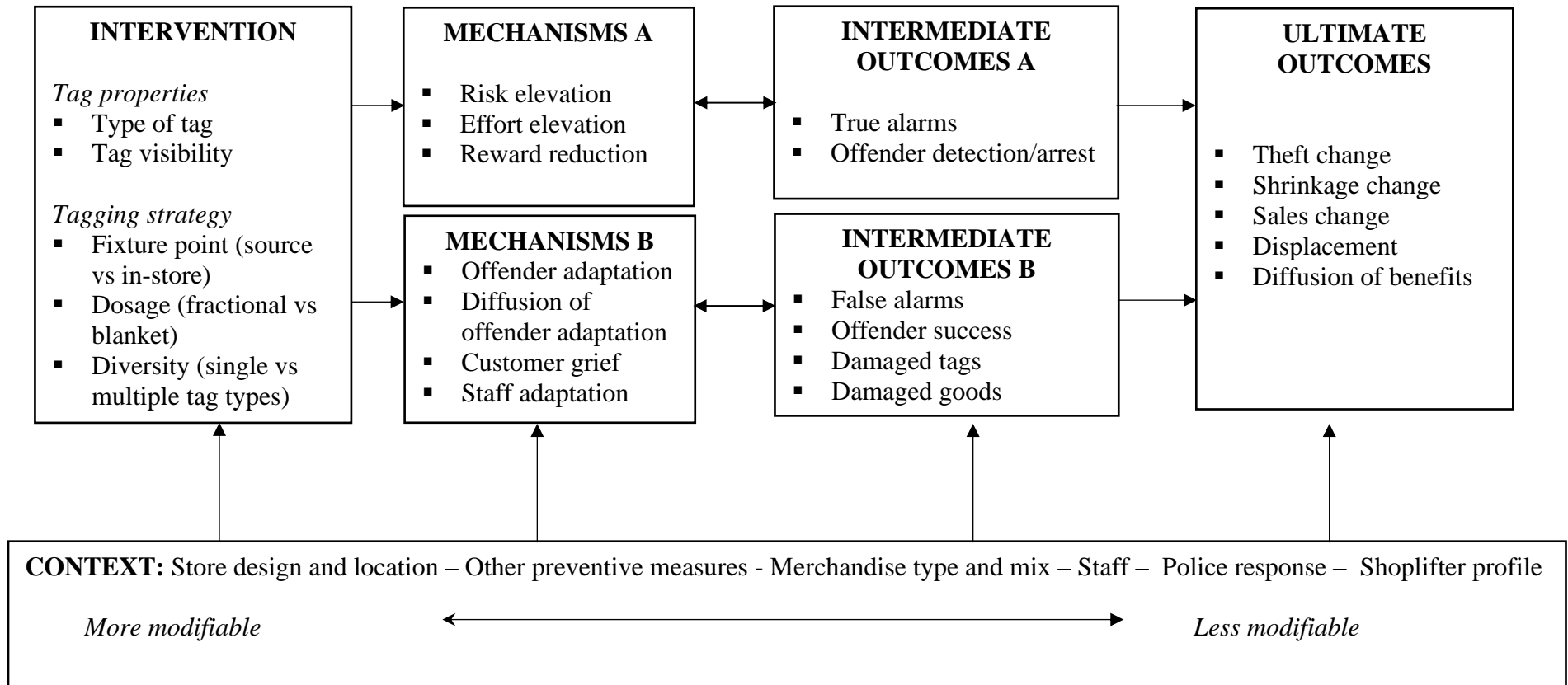
More modifiable ⟷ *Less modifiable*

Figure 1 Logic model tracing the use of security tags in retail environments