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Library Security Gates: Effectiveness and Current Practice

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Abstract

For years, library personnel have relied on security gates to prevent theft from their collections. However, recent anecdotal evidence suggests that libraries are removing the gates for various reasons including cost and patron frustration with false alarms. This study examines current practices via a survey of libraries and security gate vendors, and analyzes the effectiveness of security gates by empirical testing of alarms and with loss inventories of collection samples, supplemented by lost item statistics from interlibrary loan. Thus we use three primary methods to assess libraries' approaches to security gates.

Library collections have always faced the danger of theft, damage, and accidental loss. It's no longer standard to chain books to desks. Instead, many libraries have long relied on electromagnetic security gates that alarm when triggered by sensitized magnetic strips within books. Some systems now use RFID (radio frequency identification) or other technologies. This study examines how many libraries are using security gates of various types, and also tests the effectiveness of electromagnetic gates.

Anecdotally, library employees have observed false alarms at various libraries. These have been attributed to various causes including DVDs from rental stores, or textbooks purchased from campus bookstores. Sometimes the reverse is observed, when sensitized library materials have been passed through the gates without triggering an alarm. And of course the alarm generally acts as a deterrent rather than a preventive measure against theft. That is, the alarm merely signals the staff and the patron that a possible theft is occurring. Ideally, the staff stops the patron who comes to the service desk, and sensitized materials are found in the patron's possession. This could, of course, be a false alarm as the result of an error in the checkout process. False alarms annoy the patrons and the staff, and can result both in patrons becoming dissatisfied with the library, and in employees becoming desensitized to the alarms (the "boy who cried wolf" syndrome).

It's also possible that the patron is intentional in quickly exiting the building, and unidentified materials have been stolen. And if a patron wants to avoid triggering an alarm, they might exit with the item placed outside the range of the gate sensors, or even leave through an emergency exit door that alarms but is not monitored. Thus thefts are not necessarily prevented by security gates alone.

Lately we have been hearing anecdotes of libraries where security gates have been removed for various reasons, including patron dissatisfaction with false alarms, as well as the cost of maintaining the systems. This cost involves the gates themselves, service to the gates, sensitizing machines, magnetic strips, and processing the strips. Presumably librarians have weighed the costs and the benefits and determined that the gates are not worthwhile. This is the central question of the present study: Are security gates worth the costs? I have not sought to measure patron satisfaction, which results from many factors; but instead to analyze current practices and the effectiveness of security gates.

As the Head of Collections and Systems at a small academic library in Florida, the Olin Library of Rollins College, I have examined the issue with a multipronged approach. I have sought to answer the following questions: What methods are libraries currently using for theft prevention, and why? What do security gate vendors say about proper maintenance and use of their products? How common is the opposite of the false alarm, i.e., no alarm triggered when it should be? After removing security gates, is there a significant change in loss of materials?

Literature Review

Researchers performed collection loss studies in the early days of electromagnetic security gates. A 1978 study at the University of Pennsylvania found that the addition of security gates reduced the overall loss rate by 55%, and reduced the loss rate of recent items by 39% (Michalko and Heidtmann, 1978, p. 267). This was an update of a loss projection in 1971 at the same library, as reported by Bommer and Ford (1974), who had recommended installing security gates.

A 2005 article by a library security professional estimates that if 3% of a library collection is lost each year, according to figures from *Publishers Weekly* and from Stack (1998), an average book replacement cost of $44.65 would mean about $70,000 in annual losses for a 50,000-book collection (Gelernter, 2005, p. 13). She also states that EAS (electronic article surveillance, which includes EM [electromagnetic], RF [radio frequency, and RFID [radio frequency identification]) systems use unreliable technologies (p. 18); and that "EM systems eventually become unstable, because over time magnetization weakens" (p. 20). However, Gelernter finds that the benefits can still outweigh the costs. "A library is justified in spending triple the expected annual dollar loss amount on security so that, by the fourth year and afterward, it will profit by having a fuller collection" (p. 19).

Library RFID Ltd. conducts an annual survey on the use of RFID in libraries. The most recent data is from their 2012 survey, which for the first time expands internationally beyond the UK. Among libraries using RFID, they find that only 40% of the UK libraries cite security as a reason for using RFID, compared with 79% of the US libraries (Fortune, 2012, p. 57).

A literature review article on RFID in libraries does not mention any tests of the technology's efficacy or ROI (return on investment), but that article nevertheless advocates the use of this technology (Zimerman, 2011). Another article on the ROI of RFID in libraries finds that its primary benefits are in time-saving. The only security benefits mentioned are in terms of the time not spent inserting security strips, sensitizing, and desensitizing them (Ayre, 2012, p. 18).

Smith (1985) sounds a note of caution about designing and drawing conclusions from library security studies. First, nothing less than a complete inventory should be performed instead of relying upon annual loss rates. The replacement costs of missing items must be carefully calculated, and there are hidden costs as well, in terms of patrons being frustrated by missing books, for example.

In contrast to Smith's warning against loss samples, Foster (1996) finds that random samples can accurately suggest loss rates for an entire collection in lieu of an inventory. Citing the accuracy of Bommer and Ford's (1974) sample, Foster's own study also finds samples to be more trustworthy than Smith does.

Methodology

This mixed-methods approach has involved surveying librarians and vendors (Method I), testing security gates in two libraries (Method II), and sampling a library collection to measure any change in loss after gate removal (Method III).

Method I

I distributed an online survey link to a variety of e-mail discussion lists related to libraries, with a request to submit only one response per library. I also distributed a related survey, via individually targeted e-mails, to several library security vendors. There were no initial responses to the vendor survey, through e-mail, survey data, or other means. However, the number of responses to the library survey was surprisingly large (212) and represented several countries.

I sent the vendor survey a second time, in this instance inviting the vendors to provide confidential price estimates that would not be attributed to them in publication. This time I received two survey responses, and no further information about price estimates, etc.

In the library survey, the majority of respondents use electromagnetic (EM) security systems (66%) and/or open gate sensors (58%). 44% use video cameras; 14% have security guards (not counting circulation staff); 12% use RFID (radio frequency identification) systems. Less commonly, 5% use RF (radio frequency) systems; 4% have turnstile gates; 4% require cards for anyone to access the physical collection during operational hours; and 3% use metal-detecting gates or wands. 24% (50) do not use any type of EM/RF/RFID security gates, and 10% (22) report using no internal security measures in their libraries at all.

Anecdotal evidence suggests that it is becoming more common for libraries to remove gates, so the survey asked specifically why some libraries no longer use security gates. A separate question addressed whether the libraries had significantly altered their security measures in the past five years and why. Seventeen libraries (8% of respondents) report having removed their gates for various reasons, from aesthetics to financing. Style was a factor for two academic libraries. One reports that their gate was

"removed during a renovation. It was determined to be architecturally/aesthetically unsuitable for the 'new' foyer. [We] did not want to spend the money to replace it; figured we could buy a lot of replacement items for $20-40K." In a public library, it was decided that the gates were too expensive and that the loss was not enough to warrant the cost of that system. Twelve respondents cite cost as a factor in the decision, and there are several mentions of weighing the cost of a security system vs. the cost of lost items. One public library calls their previous system obsolete because parts were not available, the cost outweighed the utility, and it would have involved an additional "extraordinary expense" to protect audiovisual materials. According to one academic library, their system "was given up due to materials supply costs (it was not simple [magnetic strips], it was something that required supplies at every check-in)."

Some also mention operational problems with the equipment. One academic library says the vendor no longer supported their system. A small academic library of fewer than 20,000 volumes says that they had removed their previous system due to operational failure, and that their collection size had not warranted the cost of a new system. A public library reports that they had removed the gates because of "the cost of maintaining a warranty." Another public library says, "When the security gate needed repair, parts were no longer available. After checking into the replacement cost of the security gate, it was decided it was too expensive."

Another academic library has found that their migration to electronic resources makes random book losses less significant. "We have 50% less [print] books than we used to have..." Following their recent building renovation, they replaced the gates with security cameras. One new academic library has not installed gates because the "collection is entirely digital." Another academic library no longer had enough staff to monitor the exits, and found that material losses were statistically insignificant.

One public library finds the gate useful only as a visual deterrent, "wanting to give the impression that they are still in use. However, we stopped using security strips and tabs because we found it ineffective as a whole." Another public library says that when the gates had been in use, people "were still able to steal and outsmart security measures. Thus, what is the purpose of paying for security gates that do not prevent thefts[?]"

From the library survey, we see that 90% of the responding libraries are using some sort of security measure, with 76% of respondents using some type of gates. Of the 24% without gates, 1/3 of those had them in the past and decided to remove them, with cost being the most common factor cited in those decisions. Particularly in

libraries with small print or physical collections, the costs of maintaining security gates are not as easily justified.

The vendor survey asked related but different questions. The two responses to that survey are as follows:

Vendor I sells RF, RFID, video cameras, and metal detectors. Vendor II sells EM, RF, RFID, open gate sensor systems, turnstile gates, and video cameras. Regarding technical maintenance/upkeep for optimal performance, Vendor I recommends that customers "keep the system clean and do not have things interfering with it." Vendor II suggests, "Monthly checks to the system can be performed but not mandatory. A person could check to see that dust has not accumulated around the electronics chassis, but our system is designed to work 24/7 maintenance free." For quality control, both vendors advise that libraries should be "testing the system once a day with a properly tagged item."

The survey also asked about life expectancy of security tags/strips. Vendor I states that each of its RF and RFID tags last for the life of the item to which it is applied; Vendor II claims the same lifetime for its EM strips; says that "RF Hard tags will last for

decades," and "[RF] stick on tags last many years without abuse of any kind"; and that RFID tags "will last many years without abuse."

Pricing criteria for Vendor I involve the number of gates and the location of installation. Vendor II explains, "We can provide a flat rate that includes system needed, shipping and installation. Taxes if applicable would be extra." Regarding the cost of maintenance/service, Vendor I says this "depends on location and number of items; but usually averages 10% to 15% of the price of all the products both hardware and software." Vendor II states that "all of [our] equipment comes with a one year parts and labor warranty. Maintenance agreements will then be offered based on the equipment installed. Multi year discounts will also be offered. If the library does not want the Maintenance Agreement we would provide service at an hourly rate."

The vendors were also asked, "What are some of the misconceptions or issues that you encounter regarding library security systems?" Vendor I cites the misconception "that they can work by themselves without staff being involved in security." Vendor II explains, "They will not interfere with phones or pace makers." Another question asked, "Where do you see library security measures in the next 10 years?" Vendor I doesn't repond to this question, but Vendor II says, "RFID is the hot

item for libraries now. I think the security/cost aspect of the EM tags will prove to be the way to go for many decades to come."

The purpose of the vendor survey was to describe the costs and benefits of library security technologies from the vendor's point of view. Though there were only two responses, we can see that both of these vendors intend for library staff to be testing the effectiveness of their gates every day, and that the gates are meant to be kept clean and free of dust in order to function properly. The security tags or strips should not wear out over time, so alarm failures might presumably be attributed to dusty gates. While one vendor doesn't see a need for ongoing maintenance, we see that at least with the other vendor, annual maintenance contracts are generally priced at 10-15% the cost of the systems themselves.

Method II

As we have seen, both responding vendors recommend daily testing of library security gates. Method II illustrates one way this can be done. I asked specific colleagues at other libraries to participate in the second method. I provided librarians at two public libraries and four academic libraries with invitations and instructions for testing the effectiveness of electromagnetic gates in triggering alarms for sensitized

items. One of the public librarians declined because that library no longer had security gates. Voluntary participants completed testing in January 2013 at a public library in Florida and an academic library in Georgia. The instructions were to collect items from each library collection in three sets, as follows:

Group A: 5 randomly selected books and 5 DVDs catalogued within the past 5 years

Group B: 5 randomly selected books and 5 DVDs catalogued 5-10 years ago

Group C: 5 randomly selected books and 5 DVDs catalogued 11 years ago or more (very old books will work fine for this)

The instructions continued, "Walk through your library's security gates with each item separately. Step onto the other side of the gates and then return. Note whether any of these walk-throughs don't trigger alarms (there should be two walk-throughs with alarms sounding for each book, for a total of 20 alarms for each group). Let me know how many of the 20 alarms failed to sound for each of the 3 groups, and which of those are books and which are DVDs."

Both library tests documented the results specifically for books and DVDs. The academic library in the test had no pre-2003 DVDs, and their VHS collection appeared

to have no security strips. The results of the academic test showed inconsistent alarms with every set, as shown below. The failure rates are based on each set of five items being passed through the gates twice, for a total of ten attempts for each set.

Books, 2008-2013	10% failure rate
Books, 2003-2007	20% failure rate
Books, pre-2003	10% failure rate
DVDs, 2008-2013	20% failure rate
DVDs, 2003-2007	20% failure rate

To summarize the academic library test, the alarms behaved similarly and inconsistently with books and with DVDs, regardless of age. Each set showed either a 10% or 20% failure rate, and the lack of a pattern suggests that the alarms are not failing due to older security strips. And each item tested did trigger an alarm at least once in two attempts.

The results of the public library test follow.

Books, 2008-2013	0% failure rate
Books, 2003-2007	20% failure rate
Books, 1998-2003	10% failure rate
DVDs, 2008-2012	20% failure rate
DVDs, 2003-2007	20% failure rate
DVDs, 1998-2003	30% failure rate

This time one of the newest sets triggered alarms each time; and one of the oldest sets had the highest failure rate (30%). In contrast to the academic library test, we see three items that failed to trigger alarms on either attempt. Two were DVDs, and one was a book, all catalogued pre-2008. However, an age-related pattern is not supported by the results of the books. So perhaps the strips are not wearing out over time, which would support the vendor claims.

These tests used small sample sets, so the results are only meant to be anecdotal and not statistically significant. They do demonstrate that at least in two libraries, it is common for items not to trigger alarms, or to only trigger them sometimes. The tests simply illustrate a phenomenon I have observed in various other libraries over the years. If alarms are not always triggered when they should be, then the purpose of the

security gates is undermined. It is possible that both libraries' gates had collected dust which was interfering with the gate sensors. I did not ask them to clean the gates, to inspect them for dust, or to double-check that each tag was sensitized, because the purpose of this method was to test the gates' effectiveness under normal conditions.

Method III

The Olin Library at Rollins College is the only site where the third method was used. A small liberal arts college with a graduate school in business and a primarily affluent student body, Rollins had renovated its library's main floor in the summer of 2012. During construction, the electromagnetic security gates were removed from the only public entrance. Following the renovation, there was the option of replacing the gates or not. The discussion led to the idea for this study, in order to help the librarians evaluate the efficacy of the gates in relation to loss of materials. The resulting analysis would help us determine whether the gates would be worthwhile in the future. Meanwhile, we kept the gates away during the spring semester of 2013 so that a longitudinal loss inventory could be performed. We continued to apply security strips, in case we might decide to replace the gates.

The Olin Library's physical collection is small, and the study was limited to the general, reference, popular, and video collections, excluding items residing online. Thus, in contrast to libraries with larger physical collections, this sample did not need to be large in order to be significant. In order to have a 99% confidence level with a 10% margin of error, we needed 166 items in the random sample. We increased the sample size to 225 to further ensure that the results would be statistically significant. We drew random samples from the catalog, excluding periodicals, electronic resources, and archival materials. We then performed inventories of these two sample sets. From the first sample of 225 items, inventoried immediately following the removal of the security gates (during the holiday break of December 2012, between semesters), 6 items were missing (2.7%).

One missing item was a 24-page booklet which is out of print and not available for sale. According to cost data from Amazon.com, the total list price of the 5 items available for replacement is $70.82, with an average price of $14.16. This is based on the MSRP (manufacturer's suggested retail price) for in-print items, and third-party seller prices via Amazon.com for out-of-print items. None of the missing items were from the main floor, where the reference collection, the new books section, and the popular reading collection reside. This floor is open 24x7x365 and unstaffed late at night, with

access only by ID card at those times. The one missing DVD in the sample was from among 28 videos inventoried, in a collection of DVD and VHS.

In May 2013, after the end of the spring semester, another random sample of the same size was checked in a similar fashion. Again, no reference titles were found to be missing, and only one DVD was among the 9 items that were neither on the shelf nor checked out. This time, the sample included 38 videos, so the loss rate in that format (2.63%) actually decreased from the 1/28 (3.57%) in the first sample. The loss rate among books (excluding videos) increased from 6/197 (3.05%) to 9/187 (4.81%).

Overall, the missing items represented 4% (9 items) of the second sample, an increase from 2.67% (6 items) missing in the first round. One item was a leased book from the Popular Reading Collection, the only missing item from either sample that had been shelved in the 24x7 area of the library. We still have a second copy in the general collection.

The total list price of the 9 missing items from the second sample, which are all available for replacement, is $141.72 (average price of $15.75), compared with $70.82 (average price of $14.16) for the 5 replaceable items (not including the unavailable booklet) from the first sample. The increase in cost is almost exactly doubled at $70.90,

a 100.11% difference. The average cost per item increased by only $1.59 or 11.23%. However, it should be noted that some of these items (particularly in the second sample) might not be found worthy of replacement, due to their obsolescence or duplication in the collection. This qualitative element reduces the total replacement cost when we consider that some of the items would have been weeded if they had not gone missing. And with any loss sample, it should be remembered that not all "missing" items are definitely lost. Some might be temporarily in use, misplaced, or awaiting reshelving. Niland and Kurth find that subsequent searches for the same missing items can locate over half of them in some cases (1976, p. 135).

We also inventoried the first sample again in May 2013 to measure any changes in the status of these specific items. This time, 11 (4.9%) of the 225 items were missing and not checked out, nearly double the number from the same sample the previous December. None of the previously missing items had reappeared.

The replacement costs from this sample represent a total of $157.38 (average of $15.74), compared with $70.82 (average of $14.16) in the first inventory of the same sample, a 122.2% increase (not counting the out-of-print booklet as mentioned before; or one volume of a two-volume book that was missing, with a $21.95 replacement cost, but

that is available in open access). If we add the cost of replacing the open access book in print, the total is $179.33 (average of $16.30), a 153.2% increase.

Of course, the full replacement costs would also include staff time and supplies within the library, at least for those items deemed to be worthy of replacement. Likewise, the full costs of maintaining security gates would include not only the hardware, software, and maintenance contracts, but also the staff time and supplies needed for applying security tags to all items, and for regular dusting and daily testing of the gates as recommended by the vendors.

The random samples, as discussed, included some items that were obsolete and that would have been ideal candidates for weeding, if they had not gone missing. In order to gain a clearer picture of the change in loss rate of items currently in demand by patrons, I also analyzed interlibrary loan statistics as a supplementary data source. For example, in interlibrary loan we use the term "Reasons for No" to note why we decline to lend an item to another library. Two of the "Reasons for No" options in the OCLC ILL system are "Lost" and "Not on shelf." Olin Library commonly uses "Not on shelf" when appropriate. I analyzed Olin Library's "Reasons for No" for lending in February-April 2013, with no security gates, in contrast with February-April 2012, when the security gates were active. I selected these dates because they constitute the bulk of

interlibrary loan transactions during the regular semester, and they do not include major holiday or post-commencement periods. No "Lost" reasons were found during these periods; "Not on shelf" reasons were documented as follows:

Feb. 2012: 29/183 (29 items not on shelf, of a total of 183 items not lended as requested, for various reasons), 15.8%

March 2012: 24/184, 13%

April 2012: 45/167, 26.9%

Overall: 98/534, 18.4%

Feb. 2013: 15/174, 8.6%

March 2013: 14/148, 9.5%

April 2013: 18/163, 11%

Overall, 47/485, 9.7%

The ILL data suggests the opposite of the collection inventories. The loss rate by this measure has actually *decreased* with the security gates removed. The number of losses was exactly halved, and the percentage decreased by about half. The difference between the two measures could possibly be explained by the nature of the items measured. The Olin Library collection had not been weeded until a systematic project

began a few years ago, and only certain ranges have been weeded at this point. A random sample from the collection will still include items which have either been missing for years, or that are obsolete or duplicated in the collection. ILL requests reflect current patron needs. This is no reason for a decreasing loss rate in the ILL statistics, but as discussed, it is plausible that most of the items found missing in the random samples do not fit the current needs of library patrons, and we would weed some of those if we found them. Another difference in the data sets is that the ILL statistics are aggregate counts that include serials, which were excluded in the collection inventories. For example, the April 2013 "not on shelf" statistics included 5 journals among the 18 items missing.

Findings

The three methods are measuring different facets of the question of the cost-effectiveness of security gates in libraries. Method I, a survey of libraries (212 responding) and vendors (2 responding), finds that most continue to use electromagnetic (EM) security systems (66%) and/or open gate sensors (58%), while 24% use no security gates, and 10% of responding libraries use no security measures at all. 8% of those surveyed once had gates but decided to remove them. 6% specifically cite cost as a reason for removal. 76% of libraries, however, still operate some type of

security gates. The low response rate from vendors prevents us from generalizing; however, both respondents claim that their security tags are long-lived, and they recommend that security gates be tested daily and kept free of dust.

With Method II, colleagues at an academic library and a public library tested their electromagnetic security gates. Overall in both libraries, eleven random sets of five items each were tested twice, and only one set of five triggered alarms every time. There was an overall failure rate of 16.4%, with no significant difference between the two libraries. The age of the security strips had no measurable effect on the sounding of the alarm. Books failed to trigger alarms at a rate of 11.7%, and DVDs failed at 22%. DVDs failed more often at both libraries.

Method III measured the change in loss rate in a small academic library, before and after the removal of electromagnetic security gates. Random collection samples showed that the replacement costs of losses approximately doubled following removal of the gates. However, interlibrary loan statistics showed that the number of losses actually decreased in half during the same period. Taken together and without a full inventory of the collection, these directly opposing results are inconclusive.

Discussion and Further Research

Most libraries are still using security gates, although a minority of those surveyed have removed them, primarily due to their cost. Electromagnetic gates do fail to sound alarms in some cases, about twice as often with DVDs as with books. A longitudinal study with a full library inventory, with and without gates, appears to be the best way to accurately measure a change in loss rate.

The central question is whether librarians are willing to accept the costs of maintaining an electronic security system that might fail to sound an alarm with 16.4% of library materials. Further research with a library's complete inventory would accurately weigh the actual change in loss rate and replacement costs, with and without security gates. That cost could then be weighed against the cost of maintaining security gates. Maintaining security gates solely as a visual deterrent (non-functioning) could be similarly tested.

Based on the data presented here, the librarians at Rollins College's Olin Library have decided to continue operating without security gates. We will continue to apply EM security strips, as we plan to gather and analyze additional data after more time has passed. If future inventories and interlibrary loan statistics conclusively show that

security gates would be worth the cost, we might decide to install them. If this is not the case, we will discontinue the security strips and save even more on time and supply costs.

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