Home Security: The Psychological Threshold

David Strauss

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ABSTRACT

Home Security: The Psychological Threshold, explores how a thoughtful, intelligent product design solution can psychologically affect two user groups (homeowners and intruders) into opposing emotional states; safety and intimidation.

Using available statistical data and research on home burglaries, as well as inspiration from nature, present day solutions, and the environment, a conceptual security system was designed to meet the needs of suburban homeowners.

The central product, a security system, employs the use of lighting notifications to create a variety of reactive states and monitor individuals who approach a home. Based on the users intentions the monitor can; notify surrounding people about a potential threat, signal authorized or unauthorized entry to the home, and alert others to a crime in progress.

The resulting system is titled, Threshold. The Threshold system provides a variety of emotional responses for users. A sense of comfort to the occupant of the home and community, and a warning to perpetrators considering committing a crime through the system’s universally understood visible functions.
INTRODUCTION

Personal Story

The topic of this thesis was researched and executed after my views and perception on physical and psychological security were forever altered by a personal life event.

On an early morning in the fall of 2008, I received an urgent phone call stating that my father was unexpectedly rushed to the Albany Medical Center intensive care unit in Albany, New York. At the time, I was living and working hundreds of miles away in New York City, and a trip to Albany could not be made easily. My mother was understandably in a heightened emotional state due to the circumstances, but beyond my father’s health concerns she worried about her safety while alone at home.

Fortunately, my father made a full recovery after a short stay, but while he remained in the hospital my mother needed to stay home alone for several nights, and feared that a burglary might occur because of his apparent absence. Although the house was equipped with an alarm system installed in the 1970’s, it was inadequate and did not provide her with the measure of comfort that she required.

For the duration of my father’s hospital stay, I received late night and early morning phone calls from my mother for updates and to discuss her unnerved feelings of safety. My reassurances that she was safe and could easily contact the local police in a worst case scenario were logical, but did not assuage her feelings of vulnerability. The feeling of security could not be obtained by the idea that her alarm system would function to prevent a home break-in and as the system was not designed to contact the proper authorities if something was to occur.

Although no crime or burglary occurred during this period, my family was left psychologically affected by this event. Besides my father’s health concerns, what struck me the most was how quickly and easily the emotional state of safety was transferred from my mother to me, living hundreds of miles apart. It was due to this empathetic feeling of fear that I began to search for a solution to a problem I could not immediately define.
Taking cues from television commercials, newspapers, and websites, it appeared that a solution to the modern day home security system was already available. In fact, prior to my own personal life events, I was so frequently bombarded by promotional advertisements from security companies that I would often overlook their services. It just so happened that an ADT (The American District Telegraph Company) advertisement (see fig. 1) from my local newspaper caught my eye with a headline reading, “Free Home Security System!”.

My immediate reaction was to purchase a state-of-the-art security system from a private company for my parents, ensuring that they would have the very best security system on the market. Although, I was still unsure of how this system would be an advantage over their present day alarm system. I had to decide if this product would meet my own requirements and fill the growing void of security in a psychological sense.
INTRODUCTION
Present Market Solution

Upon further investigation, I examined ADT’s present day solution to home security, which to all accounts presumably works as advertised:

“As soon as an alarm signal is received from your home or business to our Customer Monitoring Center, a well-trained, helpful professional will notify you and your local police, fire department or emergency personnel. You can count on ADT to be at the ready 24 hours a day, 365 day a year.” (Our Difference)

The armed home security alarm system is activated by an individual who has triggered one or more of the following installed devices, either intentionally or unintentionally: an infrared motion sensor (see fig. 2), glass break sensor (see fig. 3), or by the disconnect of an electronic door or window sensor (see fig. 4).

Once one of these devices is triggered, a digital signal is sent out from the main system control panel via hardwired phone line, although it does not immediately call the local police. Instead, the alarm signal is sent to the ADT Customer Monitoring Center operators, who are required to go through a list of actions to determine if the alarm was tripped in error.

“A caring professional will confirm whether you are OK or in need of assistance. If there is an emergency, our professional will contact the appropriate responder (police, fire department, or emergency personnel) to dispatch assistance to your home immediately.” (Burglary Monitoring)
First, the homeowner will be contacted and verified through a series of questions, but if no one can be reached then a secondary contact may also be called before a first responder is contacted.

“When an alarm is valid, an ADT professional will contact the police, fire department, or emergency personnel to dispatch assistance to your home immediately.” (Burglary Monitoring)

ADT advises that it can take from 30 seconds up to 3 minutes for the first call to the homeowner to be made. Based on national average statistics, it also takes anywhere from 11 minutes to 1 hour for police to arrive on the scene of a crime to investigate the cause of the alarm (Criminal Victimization in the United States, Statistical Tables, 2008). Many security companies advise that the average burglary only takes a short amount of time, somewhere between 8-10 minutes to complete. With these facts in front of me I realized that a burglary would likely be done before police would be mobilized to the scene.

After discovering this new information, I was unsure if purchasing a system was going to make a difference for my own needs. I repeatedly found myself investigating the ADT advertisement (see fig. 1) that had originally caught my interest. The one piece of visual information that kept my focus was of the largest photo on the page depicting the ADT lawn sign (see fig. 5). A prominently displayed aluminum sign placed in the ground was enough for me to realize that a potential burglar may skip over a home that advertised its own modern security system. This begged the question, was it worth it to purchase a high-tech system with such a low-tech security sign? Would this potentially fulfil my desire for psychological home security?
Problem Definition

Considering the aforementioned, albeit preliminary information, I determined a problem definition that would be my thesis focal point to solve using considered and intelligent design solutions.

Existing suburban communities, neighborhoods, and homes have not been designed or modernized with the specific intent of deterring criminals and preventing burglary. The growing sophistication of perpetrators as well as homeowner error and the slowness of response officials, prevent private home security solutions from successfully reducing home invasions in suburban communities.

Thesis Statement

My product and system solution, The Threshold, intends to improve the security of existing suburban neighborhoods and the homes where people live. In comparison with current products on the market, my system is meant to be a preventative, community-based measure that empathizes with the homeowners’ emotional security needs.

The product’s specific goal is to discourage, slow, or stop a perpetrator from approaching or entering a home by forcible entry prior to the crime and notify the homeowner, renter, neighbor, and law enforcement of the act while in progress. As a result, over time a psychological security will build for the community and resident due to the physical functions of the product.
For further insight into home burglary and the background of both the perpetrator and homeowner, I sought to research more in-depth information and statistics. This supporting documentation helped me inform and define new problems, allowing me to design alternate solutions.

Beginning with the crime itself, in technical terms the Bureau of Justice classifies and defines a burglary as:

“An unlawful or forcible entry or attempted entry of a residence. This crime usually, but not always, involves theft. The illegal entry may be by force, such as breaking a window or slashing a screen, or may be without force by entering through an unlocked door or an open window. As long as the person entering has no legal right to be present in the structure a burglary has occurred. Furthermore, the structure need not be the house itself for a burglary to take place; illegal entry of a garage, shed, or any other structure on the premises also constitutes household burglary. If breaking and entering occurs in a hotel or vacation residence, it is still classified as a burglary for the household whose member or members were staying there at the time the entry occurred.” (Sedgwick Criminal Victimization Glossary)

In 2011, a total of 3.6 million household burglary victimizations took place in the United States (see table 1), a rise of 14% compared to the 2010 statistics (Truman and Planty, 2007). This statistic includes four separate subcategories that classify a burglary: completed burglary, forcible entry, unlawful entry without force, and attempted forcible entry.

The four classifications of burglary are defined as:

“Completed burglary - A form of burglary in which a person who has no legal right to be present in the structure successfully gains entry to a residence, by use of force, or without force.
Property crime increased by 11% between 2010 and 2011, the total number of property victimizations increased by 11% between 2010 and 2011, from 15,4 million to 17.1 million victimizations (table 3). During the same period, the number of burglary victimizations increased 14%, from 3.2 million to 3.6 million victimizations. Theft increased by 1.2 million victimizations, from 11.6 million in 2010 to 12.8 million in 2011. The number of motor vehicle thefts remained steady over this period with 628,000 victimizations occurring in 2011. Similar to the increase in the number of property crimes, the victimization rate for property crime also increased by 11% between 2010 and 2011, from 125.4 to 138.7 victimizations per 1,000 households (table 4). Household burglary increased 14%, from 25.8 to 29.4 victimizations per 1,000 households, and theft increased 10%, from 94.6 to 104.2 per 1,000 households. No measurable change occurred in the rate of motor vehicle theft between 2010 and 2011. Over the 10-year period between 2002 and 2011, total property crime declined 18%; however, there has been no change in the burglary rate.

### Table 3
Number of property victimizations and percent change, by type of property crime, 2002, 2010, and 2011

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>18,554,170</td>
<td>15,411,610</td>
<td>17,066,780</td>
<td>-8%†</td>
<td>11%†</td>
<td>-2%</td>
</tr>
<tr>
<td>Household burglary</td>
<td>3,251,810</td>
<td>3,176,180</td>
<td>3,613,190</td>
<td>11%‡</td>
<td>14%†</td>
<td>-</td>
</tr>
<tr>
<td>Motor vehicle theft</td>
<td>1,018,690</td>
<td>606,990</td>
<td>628,070</td>
<td>30%</td>
<td>-</td>
<td>0%</td>
</tr>
<tr>
<td>Theft</td>
<td>14,283,820</td>
<td>11,628,440</td>
<td>12,825,510</td>
<td>-10†</td>
<td>10†</td>
<td>-2</td>
</tr>
</tbody>
</table>

Note: Detail may not sum to total due to rounding. Total number of households was 110,323,840 in 2002; 122,885,160 in 2010; and 123,038,570 in 2011.

† Significant at 95%.
‡ Significant at 90%.
- Less than 0.5%.
*Calculated based on unrounded estimates.

### Table 4
Rate of property victimization and percent change, by type of property crime, 2002, 2010, and 2011

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>168.2</td>
<td>125.4</td>
<td>138.7</td>
<td>-18%†</td>
</tr>
<tr>
<td>Household burglary</td>
<td>29.5</td>
<td>25.8</td>
<td>29.4</td>
<td>-</td>
</tr>
<tr>
<td>Motor vehicle theft</td>
<td>9.2</td>
<td>4.9</td>
<td>5.1</td>
<td>-45%†</td>
</tr>
<tr>
<td>Theft</td>
<td>129.5</td>
<td>94.6</td>
<td>104.2</td>
<td>-19†</td>
</tr>
</tbody>
</table>

Note: Total number of households was 110,323,840 in 2002; 122,885,160 in 2010; and 123,038,570 in 2011.
† Significant at 95%.
- Less than 0.5%.
*Calculated based on unrounded estimates.
Forcible entry - A form of completed burglary in which force is used to gain entry to a residence. Some examples include breaking a window or slashing a screen.

Unlawful entry without force - A form of completed burglary committed by someone having no legal right to be on the premises, even though no force is used.

Attempted forcible entry - A form of burglary in which force is used in an attempt to gain entry.” (Sedgwick Criminal Victimization Glossary)

The classifications of a burglary led me to the assumption that any individual without authorization to be on a homeowner’s private property has performed an act of burglary under the law. The frequency of these acts is also important to note. The 2011 FBI “Crime Clock” (see fig. 6) statistics state that one burglary happens every 14.4 seconds in the United States (FBI - Crime Clock).

<table>
<thead>
<tr>
<th>2011 CRIME CLOCK STATISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Violent Crime occurred every</td>
</tr>
<tr>
<td>One Murder every</td>
</tr>
<tr>
<td>One Forcible Rape every</td>
</tr>
<tr>
<td>One Robbery every</td>
</tr>
<tr>
<td>One Aggravated Assault every</td>
</tr>
</tbody>
</table>

| A Property Crime occurred every | 3.5 seconds |
| One Burglary every              | 14.4 seconds |
| One Larceny-theft every         | 5.1 seconds  |
| One Motor Vehicle Theft every   | 44.1 seconds |
With such a large statistic on the amount of burglaries committed per second, it was also pertinent for me to learn how criminals were committing the crimes. The perpetrator often times accesses the homeowners dwelling through side or back entrances. Furthermore, there is no consensus among security experts on the most common location for burglaries, in some areas the front door can be the most frequented location of unlawful entry.

“In about 2/3 of reported U.S. burglaries (including commercial ones), the offenders force entry. Unsecured windows and doors (including sliding glass doors) are common entry points. Burglars typically use simple tools such as screwdrivers or crowbars to pry open weak locks, windows and doors, or they may simply break a window or kick in a door.

In about 1/3 of burglaries, the offenders do not force entry; they enter through unlocked or open windows and doors, especially basement windows and exterior and interior garage doors.

There is no consensus about the most common entry point—it depends on the house’s architecture and sitting on its lot.” (Weisel, 2002)

“More than half of burglars enter through the door so it stands to reason you should use the best doors and locks you can afford. Invest in Grade 1 deadbolts with a U.L. 437 listing – heavy duty and pick/drill resistant. The majority of locks offer far less protection than most realize.” (Security Tips to Protect your House from Burglary | Home Security Source ADT - Home Security Source)

Looking into the victims of these crimes, government statistics from multiple sources depict the highest percentages of homeowners who are most likely to be burglarized are individuals who are; single, male, under the age of 34 (see table 2) and living in an urban community. Typically the dwelling is a three-unit structure with six or more living in the household. The crimes statistically occur between 6 am - 6 pm (see table 3) while homeowners are working (see
Table 19. Property crimes, 2008:

Victimization rates, by type of crime and age of head of household

<table>
<thead>
<tr>
<th>Type of crime</th>
<th>12-19</th>
<th>20-34</th>
<th>35-49</th>
<th>50-64</th>
<th>65 or older</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property crimes</td>
<td>267.9</td>
<td>187.9</td>
<td>153.7</td>
<td>118.7</td>
<td>62.4</td>
</tr>
<tr>
<td>Household burglary</td>
<td>48.4</td>
<td>40.8</td>
<td>25.7</td>
<td>22.8</td>
<td>14.9</td>
</tr>
<tr>
<td>Completed</td>
<td>39.7</td>
<td>31.7</td>
<td>21.8</td>
<td>18.7</td>
<td>12.3</td>
</tr>
<tr>
<td>Forcible entry</td>
<td>11.9*</td>
<td>16.6</td>
<td>10.0</td>
<td>8.1</td>
<td>4.2</td>
</tr>
<tr>
<td>Unlawful entry without force</td>
<td>27.7*</td>
<td>15.2</td>
<td>11.8</td>
<td>10.6</td>
<td>8.0</td>
</tr>
<tr>
<td>Attempted forcible entry</td>
<td>8.8*</td>
<td>9.0</td>
<td>3.9</td>
<td>4.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Motor vehicle theft</td>
<td>16.7*</td>
<td>8.8</td>
<td>7.0</td>
<td>6.4</td>
<td>3.1</td>
</tr>
<tr>
<td>Completed</td>
<td>13.0*</td>
<td>6.1</td>
<td>5.9</td>
<td>4.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Attempted</td>
<td>3.7*</td>
<td>2.7</td>
<td>1.1</td>
<td>1.6</td>
<td>1.3*</td>
</tr>
<tr>
<td>Theft</td>
<td>202.7</td>
<td>138.4</td>
<td>121.0</td>
<td>89.4</td>
<td>44.4</td>
</tr>
<tr>
<td>Completed</td>
<td>197.9</td>
<td>132.5</td>
<td>115.1</td>
<td>84.9</td>
<td>41.5</td>
</tr>
<tr>
<td>Less than $50</td>
<td>32.6</td>
<td>29.8</td>
<td>26.7</td>
<td>22.7</td>
<td>13.0</td>
</tr>
<tr>
<td>$50 - $249</td>
<td>65.8</td>
<td>48.3</td>
<td>43.0</td>
<td>29.5</td>
<td>11.4</td>
</tr>
<tr>
<td>$250 or more</td>
<td>80.2</td>
<td>40.2</td>
<td>31.2</td>
<td>21.0</td>
<td>11.2</td>
</tr>
<tr>
<td>Amount not available</td>
<td>19.3*</td>
<td>14.2</td>
<td>14.3</td>
<td>11.7</td>
<td>5.9</td>
</tr>
<tr>
<td>Attempted</td>
<td>4.8*</td>
<td>5.9</td>
<td>5.8</td>
<td>4.6</td>
<td>2.9</td>
</tr>
<tr>
<td>Total number of households</td>
<td>1,267,680</td>
<td>26,940,670</td>
<td>36,190,160</td>
<td>32,253,420</td>
<td>24,489,120</td>
</tr>
</tbody>
</table>

Note: Detail may not add to total shown because of rounding.
*Estimate is based on 10 or fewer sample cases.
Table 59. Personal and property crimes, 2008:

Percent distribution of incidents, by type of crime and time of occurrence

<table>
<thead>
<tr>
<th>Type of crime</th>
<th>Number of incidents</th>
<th>Percent of incidents</th>
<th>Daytime</th>
<th>Nighttime</th>
<th>Not known or not available</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>6 a.m.-6 p.m.</td>
<td>Total</td>
<td>6 p.m.-midnight</td>
<td>Total</td>
</tr>
<tr>
<td>Crimes of violence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed violence</td>
<td>1,291,780</td>
<td>100 %</td>
<td>43.9</td>
<td>43.5</td>
<td>11.3</td>
</tr>
<tr>
<td>Attempted/threatened violence</td>
<td>3,289,490</td>
<td>100 %</td>
<td>47.4</td>
<td>39.4</td>
<td>21.7</td>
</tr>
<tr>
<td>Rape/Sexual assault</td>
<td>200,520</td>
<td>100 %</td>
<td>42.5</td>
<td>55.8</td>
<td>32.8</td>
</tr>
<tr>
<td>Robbery</td>
<td>504,110</td>
<td>100 %</td>
<td>49.5</td>
<td>41.5</td>
<td>23.2</td>
</tr>
<tr>
<td>Attempted to take</td>
<td>157,870</td>
<td>100 %</td>
<td>42.7</td>
<td>57.3</td>
<td>31.9</td>
</tr>
<tr>
<td>With injury</td>
<td>56,800</td>
<td>100 %</td>
<td>55.0</td>
<td>64.1</td>
<td>12.9</td>
</tr>
<tr>
<td>Without injury</td>
<td>101,070</td>
<td>100 %</td>
<td>35.9</td>
<td>46.0</td>
<td>11.1</td>
</tr>
<tr>
<td>Assault</td>
<td>3,876,640</td>
<td>100 %</td>
<td>47.4</td>
<td>46.0</td>
<td>11.1</td>
</tr>
<tr>
<td>Aggravated</td>
<td>788,770</td>
<td>100 %</td>
<td>44.6</td>
<td>52.5</td>
<td>21.5</td>
</tr>
<tr>
<td>Simple</td>
<td>3,107,870</td>
<td>100 %</td>
<td>57.4</td>
<td>39.2</td>
<td>28.4</td>
</tr>
<tr>
<td>Property crimes</td>
<td>16,319,180</td>
<td>100 %</td>
<td>40.5</td>
<td>42.9</td>
<td>12.7</td>
</tr>
<tr>
<td>Household burglary</td>
<td>3,188,620</td>
<td>100 %</td>
<td>46.0</td>
<td>33.2</td>
<td>10.2</td>
</tr>
<tr>
<td>Completed</td>
<td>2,598,960</td>
<td>100 %</td>
<td>48.1</td>
<td>29.6</td>
<td>8.8</td>
</tr>
<tr>
<td>Forcible entry</td>
<td>1,191,290</td>
<td>100 %</td>
<td>52.2</td>
<td>30.1</td>
<td>8.5</td>
</tr>
<tr>
<td>Unlawful entry without force</td>
<td>1,407,670</td>
<td>100 %</td>
<td>44.6</td>
<td>29.3</td>
<td>9.1</td>
</tr>
<tr>
<td>Attempted forcible entry</td>
<td>589,660</td>
<td>100 %</td>
<td>36.9</td>
<td>48.8</td>
<td>16.5</td>
</tr>
<tr>
<td>Motor vehicle theft</td>
<td>795,160</td>
<td>100 %</td>
<td>26.8</td>
<td>65.3</td>
<td>16.5</td>
</tr>
<tr>
<td>Completed</td>
<td>593,300</td>
<td>100 %</td>
<td>30.2</td>
<td>61.9</td>
<td>17.1</td>
</tr>
<tr>
<td>Attempted</td>
<td>201,860</td>
<td>100 %</td>
<td>16.7</td>
<td>75.2</td>
<td>14.7</td>
</tr>
<tr>
<td>Theft</td>
<td>12,336,400</td>
<td>100 %</td>
<td>39.9</td>
<td>43.9</td>
<td>13.1</td>
</tr>
<tr>
<td>Completed</td>
<td>11,740,750</td>
<td>100 %</td>
<td>40.7</td>
<td>43.0</td>
<td>12.9</td>
</tr>
<tr>
<td>Less than $50</td>
<td>2,859,180</td>
<td>100 %</td>
<td>40.2</td>
<td>39.8</td>
<td>10.1</td>
</tr>
<tr>
<td>$50 - $249</td>
<td>4,169,140</td>
<td>100 %</td>
<td>42.6</td>
<td>43.6</td>
<td>13.8</td>
</tr>
<tr>
<td>$250 or more</td>
<td>3,265,320</td>
<td>100 %</td>
<td>37.3</td>
<td>48.4</td>
<td>14.5</td>
</tr>
<tr>
<td>Amount not available</td>
<td>1,447,100</td>
<td>100 %</td>
<td>44.0</td>
<td>35.5</td>
<td>12.4</td>
</tr>
</tbody>
</table>

Note: Detail may not add to total shown because of rounding.
*Estimate is based on 10 or fewer sample cases.
*Includes verbal threats of rape and threats of sexual
table 4) during the late summer months of July or August. As of 2009, the average value lost per burglary in the United States was $2,709 (see table 5).

An additional cause for alarm is when home invasions involve the addition of violent assaults on victims who are present during the crime.

“While most home invasions are listed as burglaries or assaults, this recent Department of Justice report lists dedicated home invasion statistics. 38 percent of assaults and 60 percent of rapes occur during home invasions. One in five homes undergoes a home invasion or break-in. There are more than 8,000 home invasions every day in North America. 50 percent of home invasions involve the use of a weapon; the most common weapons used are knives or other cutting instruments. In 48 percent of home invasions, victims sustain physical injuries. Victims age 60 or older make up 17 percent of home invasion victims. In 68 percent of home invasions, victims and the accused are strangers; in 11 percent of these cases, victims and the accused are friends, business associates, or family” (Crew, 2011)

The master bedroom is the area of the home that is most frequently vandalized in home invasions. Burglars typically seek guns, jewelry, collectibles, safes, and cash in these bedrooms. The second most frequented area is the home office where televisions, game consoles, and electronics are often found (see table 6).

Given this information, it was clear that home burglaries are a cause of concern and happen more frequently than I expected. Statistically, my own family’s demographics did not fall into the highest percentage of those who were vandalized, but this data left no doubt in my mind it was still an issue. Having factual knowledge at hand I moved forwards to understand what other preventative measures homeowners could take to protect themselves and their families.
Table 64. Personal and property crimes, 2008:

Percent distribution of incidents, by victim’s activity at time of incident and type of crime

<table>
<thead>
<tr>
<th>Type of crime</th>
<th>Number of incidents</th>
<th>Working on duty</th>
<th>On the way to or from work</th>
<th>On the way to or from school</th>
<th>On the way to or from some other place</th>
<th>Shopping or running errands</th>
<th>Attending school</th>
<th>Leisure activity away from home</th>
<th>Sleeping</th>
<th>Other activities at home</th>
<th>Other</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crimes of violence</td>
<td>4,581,260</td>
<td>100 %</td>
<td>14.8</td>
<td>3.9</td>
<td>5.1</td>
<td>7.4</td>
<td>5.1</td>
<td>10.1</td>
<td>29.6</td>
<td>2.7</td>
<td>25.4</td>
<td>3.5</td>
</tr>
<tr>
<td>Rape/sexual assault</td>
<td>200,520</td>
<td>100 %</td>
<td>6.3 *</td>
<td>2.0 *</td>
<td>6.4 *</td>
<td>8.2 *</td>
<td>1.6 *</td>
<td>12.1 *</td>
<td>17.7 *</td>
<td>6.6 *</td>
<td>39.0</td>
<td>0.0 *</td>
</tr>
<tr>
<td>Robbery</td>
<td>304,110</td>
<td>100 %</td>
<td>2.3 *</td>
<td>11.8</td>
<td>7.1 *</td>
<td>13.4</td>
<td>9.5</td>
<td>4.6 *</td>
<td>22.6</td>
<td>5.8 *</td>
<td>18.2</td>
<td>3.2 *</td>
</tr>
<tr>
<td>Aggravated assault</td>
<td>768,770</td>
<td>100 %</td>
<td>12.9</td>
<td>3.5 *</td>
<td>2.9 *</td>
<td>10.1</td>
<td>7.4</td>
<td>4.4 *</td>
<td>23.1</td>
<td>2.0 *</td>
<td>27.1</td>
<td>3.3 *</td>
</tr>
<tr>
<td>Simple assault</td>
<td>3,107,870</td>
<td>100 %</td>
<td>17.8</td>
<td>2.9</td>
<td>5.2</td>
<td>5.7</td>
<td>4.1</td>
<td>12.2</td>
<td>19.9</td>
<td>2.1</td>
<td>25.2</td>
<td>3.8</td>
</tr>
<tr>
<td>Purse snatching/pocket picking</td>
<td>136,710</td>
<td>100 %</td>
<td>3.8 *</td>
<td>5.9 *</td>
<td>8.6 *</td>
<td>9.5 *</td>
<td>19.3 *</td>
<td>4.8 *</td>
<td>36.8</td>
<td>4.2 *</td>
<td>4.5 *</td>
<td>2.5 *</td>
</tr>
<tr>
<td>Property crimes</td>
<td>16,319,180</td>
<td>100 %</td>
<td>14.7</td>
<td>0.9</td>
<td>0.4</td>
<td>1.7</td>
<td>5.3</td>
<td>4.5</td>
<td>14.2</td>
<td>27.5</td>
<td>11.0</td>
<td>3.4</td>
</tr>
<tr>
<td>Household burglary</td>
<td>3,186,620</td>
<td>100 %</td>
<td>23.6</td>
<td>1.2</td>
<td>0.2 *</td>
<td>3.5</td>
<td>5.9</td>
<td>1.1 *</td>
<td>19.1</td>
<td>15.5</td>
<td>8.6</td>
<td>4.2</td>
</tr>
<tr>
<td>Motor vehicle theft</td>
<td>275,140</td>
<td>100 %</td>
<td>9.5</td>
<td>1.1 *</td>
<td>0.0 *</td>
<td>0.4 *</td>
<td>6.0</td>
<td>0 *</td>
<td>11.4</td>
<td>41.4</td>
<td>14.3</td>
<td>4.1 *</td>
</tr>
<tr>
<td>Theft</td>
<td>12,335,400</td>
<td>100 %</td>
<td>12.8</td>
<td>0.8</td>
<td>0.5</td>
<td>1.4</td>
<td>5.1</td>
<td>5.7</td>
<td>13.2</td>
<td>29.7</td>
<td>11.4</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Note: Detail may not add to total shown because of rounding.
*Estimates are based on 10 or fewer sample cases.
†Includes verbal threats of rape and threats of sexual assault.
### Table 321. Robbery and Property Crimes by Type and Average Value Lost: 1990 to 2009

(639 represents 639,000. For year ending December 31)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Robbery, total 1</td>
<td>639</td>
<td>408</td>
<td>417</td>
<td>342</td>
<td>256</td>
<td>.3</td>
<td>144</td>
<td>.9</td>
<td>140</td>
<td>.7</td>
<td>125</td>
<td>.1</td>
</tr>
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<td>Type of crime:</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street or highway</td>
<td>359</td>
<td>188</td>
<td>184</td>
<td>146</td>
<td>639</td>
<td>408</td>
<td>417</td>
<td>342</td>
<td>256</td>
<td>.3</td>
<td>144</td>
<td>.9</td>
</tr>
<tr>
<td>Commercial house</td>
<td>73</td>
<td>57</td>
<td>60</td>
<td>46</td>
<td>29.5</td>
<td>20.1</td>
<td>20.1</td>
<td>16.9</td>
<td>945</td>
<td>1,685</td>
<td>1,662</td>
<td>1,774</td>
</tr>
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<td>Gas station</td>
<td>18</td>
<td>12</td>
<td>12</td>
<td>8</td>
<td>7.1</td>
<td>4.1</td>
<td>4.0</td>
<td>3.0</td>
<td>423</td>
<td>679</td>
<td>1,104</td>
<td>862</td>
</tr>
<tr>
<td>Convenience store</td>
<td>39</td>
<td>26</td>
<td>24</td>
<td>18</td>
<td>15.6</td>
<td>9.3</td>
<td>8.0</td>
<td>6.7</td>
<td>344</td>
<td>566</td>
<td>677</td>
<td>717</td>
</tr>
<tr>
<td>Residence</td>
<td>62</td>
<td>0</td>
<td>20</td>
<td>25.1</td>
<td>17.7</td>
<td>20.0</td>
<td>21.1</td>
<td>628</td>
<td>1,243</td>
<td>1,332</td>
<td>1,674</td>
<td></td>
</tr>
<tr>
<td>Weapon used:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firearm</td>
<td>234</td>
<td>107</td>
<td>109</td>
<td>76</td>
<td>46.6</td>
<td>24.1</td>
<td>20.9</td>
<td>16.7</td>
<td>628</td>
<td>1,243</td>
<td>1,332</td>
<td>1,674</td>
</tr>
<tr>
<td>Knife or cutting instrument</td>
<td>76</td>
<td>36</td>
<td>37</td>
<td>24</td>
<td>20.7</td>
<td>12.8</td>
<td>12.5</td>
<td>9.8</td>
<td>344</td>
<td>566</td>
<td>677</td>
<td>717</td>
</tr>
<tr>
<td>Other weapon</td>
<td>61</td>
<td>53</td>
<td>59</td>
<td>58</td>
<td>25.1</td>
<td>17.7</td>
<td>20.0</td>
<td>21.1</td>
<td>628</td>
<td>1,243</td>
<td>1,332</td>
<td>1,674</td>
</tr>
<tr>
<td>Strong-arm</td>
<td>268</td>
<td>159</td>
<td>166</td>
<td>126</td>
<td>107.7</td>
<td>56.4</td>
<td>56.0</td>
<td>53.3</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
</tr>
<tr>
<td>Burglary, total 2</td>
<td>3,074</td>
<td>2,050</td>
<td>2,154</td>
<td>1,955</td>
<td>1,232.2</td>
<td>728.4</td>
<td>726.7</td>
<td>715.7</td>
<td>1,014</td>
<td>1,458</td>
<td>1,771</td>
<td>2,087</td>
</tr>
<tr>
<td>Forcible entry 2</td>
<td>2,150</td>
<td>1,297</td>
<td>1,310</td>
<td>1,224</td>
<td>864.5</td>
<td>460.7</td>
<td>440.0</td>
<td>448.1</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
</tr>
<tr>
<td>Unlawful entry 2</td>
<td>678</td>
<td>615</td>
<td>701</td>
<td>655</td>
<td>272.8</td>
<td>218.7</td>
<td>237.5</td>
<td>239.7</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
</tr>
<tr>
<td>Attempted forcible entry 2</td>
<td>245</td>
<td>138</td>
<td>133</td>
<td>129</td>
<td>98.7</td>
<td>49.0</td>
<td>65.2</td>
<td>47.4</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
</tr>
<tr>
<td>Residence</td>
<td>2,033</td>
<td>1,335</td>
<td>1,417</td>
<td>1,127</td>
<td>817.4</td>
<td>474.3</td>
<td>477.9</td>
<td>412.9</td>
<td>1,037</td>
<td>1,378</td>
<td>1,813</td>
<td>2,709</td>
</tr>
<tr>
<td>Nonresidence</td>
<td>1,041</td>
<td>715</td>
<td>738</td>
<td>407</td>
<td>418.5</td>
<td>254.1</td>
<td>248.8</td>
<td>148.8</td>
<td>967</td>
<td>1,010</td>
<td>1,687</td>
<td>2,521</td>
</tr>
<tr>
<td>Occurred during the night 2</td>
<td>1,135</td>
<td>699</td>
<td>706</td>
<td>625</td>
<td>456.4</td>
<td>248.3</td>
<td>238.9</td>
<td>229.0</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
</tr>
<tr>
<td>Occurred during the day 2</td>
<td>1,151</td>
<td>863</td>
<td>890</td>
<td>910</td>
<td>462.8</td>
<td>237.2</td>
<td>328.8</td>
<td>332.8</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
</tr>
<tr>
<td>Larceny-theft, total 3</td>
<td>7,946</td>
<td>6,972</td>
<td>6,783</td>
<td>5,560</td>
<td>3,185</td>
<td>2,477</td>
<td>2,286</td>
<td>2,035</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
</tr>
<tr>
<td>Pocket picking</td>
<td>81</td>
<td>36</td>
<td>29</td>
<td>24</td>
<td>32.4</td>
<td>12.7</td>
<td>9.8</td>
<td>8.8</td>
<td>384</td>
<td>437</td>
<td>346</td>
<td>489</td>
</tr>
<tr>
<td>Purse snatching</td>
<td>82</td>
<td>37</td>
<td>42</td>
<td>27</td>
<td>32.6</td>
<td>13.2</td>
<td>14.2</td>
<td>9.3</td>
<td>228</td>
<td>387</td>
<td>404</td>
<td>440</td>
</tr>
<tr>
<td>Shoplifting</td>
<td>1,291</td>
<td>929</td>
<td>940</td>
<td>1,002</td>
<td>519.1</td>
<td>349.7</td>
<td>317.0</td>
<td>366.9</td>
<td>104</td>
<td>185</td>
<td>164</td>
<td>178</td>
</tr>
<tr>
<td>From motor vehicles</td>
<td>1,744</td>
<td>1,754</td>
<td>1,752</td>
<td>1,520</td>
<td>701.3</td>
<td>623.3</td>
<td>590.6</td>
<td>556.5</td>
<td>461</td>
<td>692</td>
<td>704</td>
<td>737</td>
</tr>
<tr>
<td>Motor vehicle accessories</td>
<td>1,185</td>
<td>677</td>
<td>653</td>
<td>501</td>
<td>476.3</td>
<td>240.6</td>
<td>233.6</td>
<td>183.2</td>
<td>297</td>
<td>451</td>
<td>482</td>
<td>528</td>
</tr>
<tr>
<td>Bicycles</td>
<td>443</td>
<td>312</td>
<td>249</td>
<td>187</td>
<td>178.2</td>
<td>110.9</td>
<td>83.9</td>
<td>67.6</td>
<td>188</td>
<td>273</td>
<td>267</td>
<td>345</td>
</tr>
<tr>
<td>From buildings</td>
<td>1,108</td>
<td>982</td>
<td>965</td>
<td>820</td>
<td>449.4</td>
<td>324.6</td>
<td>287.3</td>
<td>228.5</td>
<td>673</td>
<td>1,184</td>
<td>1,738</td>
<td>1,233</td>
</tr>
<tr>
<td>From coin-operated machines.</td>
<td>63</td>
<td>46</td>
<td>41</td>
<td>22</td>
<td>25.4</td>
<td>16.2</td>
<td>13.8</td>
<td>8.1</td>
<td>144</td>
<td>272</td>
<td>232</td>
<td>348</td>
</tr>
<tr>
<td>Other</td>
<td>1,940</td>
<td>2,232</td>
<td>2,184</td>
<td>1,660</td>
<td>780.0</td>
<td>793.0</td>
<td>736.1</td>
<td>607.5</td>
<td>615</td>
<td>957</td>
<td>1,137</td>
<td>1,439</td>
</tr>
<tr>
<td>Motor vehicles, total</td>
<td>1,638</td>
<td>1,160</td>
<td>1,236</td>
<td>731</td>
<td>655.8</td>
<td>412.2</td>
<td>417.4</td>
<td>258.6</td>
<td>5,117</td>
<td>6,581</td>
<td>6,204</td>
<td>6,495</td>
</tr>
<tr>
<td>Automobiles, total</td>
<td>1,304</td>
<td>877</td>
<td>907</td>
<td>527</td>
<td>524.3</td>
<td>311.5</td>
<td>304.5</td>
<td>193.0</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
</tr>
<tr>
<td>Trucks and buses</td>
<td>238</td>
<td>209</td>
<td>219</td>
<td>205</td>
<td>95.5</td>
<td>74.1</td>
<td>76.2</td>
<td>74.9</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
<td>(NA)</td>
</tr>
</tbody>
</table>

NA  Not available.  1 Includes other crimes, not shown separately.  2 Unknown data not included.  3 Includes other types of motor vehicles, not shown separately.

Source: U.S. Department of Justice, Federal Bureau of Investigation, Uniform Crime Reports, Return A and Supplement to Return A Master Files.
Table 84. Personal and property crimes, 2008:

Number and percent distribution of victimizations resulting in theft loss, by type of crime and type of property stolen

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<thead>
<tr>
<th>Type of property loss</th>
<th>Household burglary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>Total</td>
<td>3,724,670</td>
</tr>
<tr>
<td>Cash</td>
<td>390,020</td>
</tr>
<tr>
<td>Purse, wallet, credit cards</td>
<td>189,220</td>
</tr>
<tr>
<td>Vehicle or parts</td>
<td>174,370</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>18,380</td>
</tr>
<tr>
<td>Vehicle parts</td>
<td>19,140</td>
</tr>
<tr>
<td>Unattached vehicle accessories</td>
<td>18,390</td>
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<tr>
<td>Bicycle or parts</td>
<td>118,460</td>
</tr>
<tr>
<td>Household furnishings</td>
<td>490,670</td>
</tr>
<tr>
<td>Personal effects</td>
<td>1,678,950</td>
</tr>
<tr>
<td>Portable electronic, photographic gear</td>
<td>609,980</td>
</tr>
<tr>
<td>Jewelry, clothing</td>
<td>612,950</td>
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<tr>
<td>Other personal effects</td>
<td>456,030</td>
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<tr>
<td>Firearms</td>
<td>101,860</td>
</tr>
<tr>
<td>Tools, machinery</td>
<td>377,040</td>
</tr>
<tr>
<td>Other</td>
<td>322,540</td>
</tr>
</tbody>
</table>

Note: Detail may not add to total shown because of rounding and because some respondents cited multiple items stolen.
*Estimate is based on 10 or fewer sample cases.
*Includes data on rape and sexual assault, not shown separately.
With the knowledge of the limitations of high-tech systems and high crime statistics for home invasions, I began to look for alternate tactical solutions. Many of these solutions are highly recommended by security professionals in the field. From a compiled list, I broke these tactics down into two categories; physical and psychological, and I identified how and why these solutions contributed to the prevention of a crime.

Beginning with physical tactics, the most commonly recommended security solutions ask homeowners to install the following barriers, often in tandem:

- Chain locks to secure doors (see fig. 7)
- Additional dead bolts and cam-locks for door reinforcement (see fig. 8)
- Steel window bars (see fig. 9)
- Additional door gates (see fig. 10)
- Aluminum home security shutters (see fig. 11)
- Extra window and door locks (see fig. 12)
- Reinforced door with a thick solid core (see fig. 13)
- Rose or thorny bushes in front of windows to limit mobility (see fig. 14)
- Anti-break window film (see fig. 15)
- Anti-kick doors (see fig. 16)
- Broken glass shards on wall ledges that would cut a would-be burglar (see fig. 17)
- Fences or walls that are not easy to jump over (see fig. 18)
- Three-inch screws used to mount doorframe hardware
- Solar screens that are hard to remove once mounted
- Door jammers that prevent doors from swinging freely

These barrier type options are meant to slow or stop an individual from physically entering a dwelling or household. Many of these can be seen in use at suburban neighborhood homes, but these simple physical barriers are easy for burglars to overcome by sophisticated means or by brute force.
RESEARCH
 Alternate Tactical Solutions

Figure 7. Chain Lock
Figure 8. Dead Bolt
Figure 9. Window Bars

Figure 10. Gates
Figure 11. Security Shutters
Figure 12. Window Locks

Figure 13. Reinforced Doors
Figure 14. Thorn Bushes
Figure 15. Anti-shatter Glass

Figure 16. Anti-kick Doors
Figure 17. Walls
Figure 18. Fences
Recommended psychological tactics become extreme or even comedic in some cases. Security professionals in the field suggest using the follow tactics as means of prevention only:

- Beware of dog signs  (see fig. 19)
- Dogs with a loud bark
- A large bowl of dog food outside
- Trim exterior vegetation or hedges low to the ground  (see fig. 20)
- Displaying the NRA graphic sticker  (see fig. 21)
- Placing a pair of men’s boots in front of the home  (see fig. 22)
- Security or internet cameras  (see fig. 23)
- Hanging a used shooting range target in a garage space  (see fig. 24)
- Bright exterior lights that are hard to reach or remove  (see fig. 25)
- Remote light timers’ on appliances  (see fig. 26)
- Closing curtains at night to prevent anyone from seeing in  (see fig. 27)
- Motion sensor lighting  (see fig. 28)
- Visible house numbers for police to identify  (see fig. 29)
- Peepholes in entry doors  (see fig. 30)
- Alarm system decals and graphics
- LED lights displaying the presence of a security system
- Using a life-size cardboard cutout of a person that can be put it a few feet away from a window giving the impression that someone is home
- Muting phone ringers while away
- Talk AM radio stations on loud all day and night while you are gone

Each one of these tactics has a unique effect to potentially discourage a burglar from committing a crime. For a majority of these options, the tactic of a potential security measure is enough to make a criminal second guess their actions.
Alternate Tactical Solutions

Figure 19.
Attack Dog Sign

Figure 20.
Hedges

Figure 21.
NRA Sticker

Figure 22.
Mens Boots

Figure 23.
Security Camera

Figure 24.
Target

Figure 25.
Exterior Lights

Figure 26.
Light Timer

Figure 27.
Curtains

Figure 28.
Motion Sensor

Figure 29.
House Numbers

Figure 30.
Peep Hole
Several other homeowner defense tactics have also been recommended and although they do not directly relate to the prevention of a burglary from occurring, many are important to note for this body of research. These additional suggestions include:

- A handheld or wall mounted panic button that can connect to a security system or law enforcement
- A phone at the homeowner's bed side incase of emergency
- While on vacation do not post to social media on the internet (Facebook or Twitter)
- Have a neighbor pick up mail or newspapers if you are away for extended duration of time
- Community watch groups in neighborhoods
- Unusual hiding places for valuables
- Sunken floor safe
- A clean yard with no heavy object that can be thrown through windows
- Safe rooms (otherwise known as panic rooms)
- Taking precautions to disguise trash you leave out (boxes from electronics)
- Shred important documents or papers with personal information

After careful review of the many alternate tactical solutions to prevent burglary, I discovered that my parents' household already used a large majority of physical and psychological barriers. Regardless that more could be put in place, it still seemed as though a security hole was present, and therefore the reasoning behind a venture to discover new solutions.
Looking beyond statistics and tactical solutions for more detail, I literally searched for the location or the point at where an individual physically and metaphorically crosses a line to threaten or commit a home invasion. In doing so, I came across the following definition of threshold.

“thresh·old  noun  \'thresh-,hold, ‘thre-,shold\  
1. a : the plank, stone, or piece of timber that lies under a door: sill (see fig. 31)  
2. a : gate, door  
   b (1) : end, boundary; specifically: the end of a runway  
   (2) : the place or point of entering or beginning: outset”  

("Threshold." Merriam-Webster)
Continuing past the physical definition of a threshold, I discovered that its meaning went far beyond my original intent and intersected the psychological area I was most interested in.

“3. a : the point at which a physiological or psychological effect begins to be produced
   b : a level, point, or value above which something is true or will take place and below which it is not or will not” (“Threshold.” Merriam-Webster)

“5. a : a level or point at which something would happen, would cease to happen, or would take effect, become true, etc
   b : (as modifier): threshold price; threshold effect
6. a : the minimum intensity or value of a signal, etc, that will produce a response or specified effect: a frequency threshold
   b : (as modifier): a threshold current” (“Threshold.” Dictionary.com)

The term threshold easily defined and encompassed both the physical and psychological representations that I required from a security system. A threshold is the point at which an individual would cross to enter the home, as well as the effect where they would begin to feel a change in emotion. This basic information helped to inform my initial design concepts as I moved forwards.
For additional design inspiration I researched various sources. One of my most interesting findings was investigating biomimicry. The animal kingdom provides many examples of natural security systems that have evolved over millions of years. I turned to biomimicry for concepts I could borrow for my envisioned threshold security system. My short list began with the following animals and their basic defense mechanisms:

- Cats and dogs - hiss and bark
- Skunks - horrid smell
- Bees and Scorpions - poisonous stings
- Armadillos, Lobsters, and Crabs - shells and exoskeletons
- Bull frogs - increase in size
- Chameleons - camouflage
- Snakes and Spiders - venomous bites
- Porcupines - detachable quills
- Squids - ink screens
- Bears - increase in posture and display of teeth
- Tiger pistol shrimp - high decibel sound
- Striped polecat - foul-smelling excretion
- Jellyfish - bioluminescence

Some of the examples were impractical when conceptualizing a modern day system or product. The potential to cause serious injury or bodily harm to users of my system was not my intent and several ideas were not fit to be explored further.
One practical concept I began to explore was the use of light as a visual alert. The most extreme biomimicry case study I drew inspiration from was the use of a bioluminescence glow when an animal is in mortal danger. The Atolla Jellyfish (see fig. 32) has especially fascinating natural defense mechanism. It specifically uses a “burglar alarm response” through the use of light to confuse an attacker while simultaneously signaling larger predators that may come to the area to investigate (or eradicate) the initial threat.

“When threatened the jellyfish sometimes responds by creating a moving circular wave of light around their outer edge which is referred to as a “burglar alarm” response.” (Salleh, 2003)

“The sudden burst of light causes a commotion to confuse the aggressor, and attracts larger predators that might want to feed on the instigator.” (Smithsonian’s National Zoo - Living Light, 2006)
I further researched animal swarms (see fig. 33) and their effect on the attacking predators. Security in nature is achieved by the mass collection of animals to reduce the effectiveness of an aggressor. Simply put, an early warning system is created in a group by working together. It is enough to confuse the enemy and reduce their attacking abilities.

“When confronted with a swarm of their prey, many predators become confused and are less successful in their attacks… The formation of animal swarms, where sometimes tons of biomass accumulates in a small space, is a spectacular phenomenon… Animals form swarms because of foraging, energetic, defensive and other benefits: for example, they find food faster when they search together, they save energy when they move together, and they are better defended when they are together. Defense functions of gregariousness can be subdivided into the dilution effect on the one hand and effects that decrease predator hunting success on the other. Examples of these latter effects are early warning and a reduced detection probability by the predator and, the potential for active defense and the confusion effect… The confusion effect is present if predators that are confronted with a swarm of their prey are restricted by their neuronal abilities, causing them to be less successful in their attacks.” (Jeschke and Tollrian, 2007)
The currently used solution of neighborhood security signs kept showing value throughout my initial research. The original inspiration of a static sign was looking more like an important piece of ornamentation the further along I went in my research. The value that a security lawn signs play towards psychological security and psychological risk-taking for potential criminals in a suburban environment needed additional examination.

Viewing a variety of signs (see fig. 34-41), several themes kept reappearing. A particular style of graphic language was developed by different designers to provide the proper message to the homeowner and potential perpetrator.

While looking at the silhouettes from a grouping of security signs, common themes of official police shields and stop signs appeared. The scale of each sign was oversized and visible from several feet away. A sans-serif bold typeface was used in a large point size to display powerful wording like; secure, security, protected, law, enforced, alert, monitor, system, protected, warning, and alarm. The colors of blue, black, red, white, and gold were exclusively used throughout. All of the signs advertised exactly who produced the product or system (i.e.: ADT, BRINKS, PACM, PINNICLE).

Based on these findings I made a clear determination on what the security industry agrees to be a standard in regards to graphics signage. None of the cases shown (see fig. 34-41) have any actual physical role in the security system, other than the notification that a system is present on the homeowners’ premises. The signs lack the ability to function beyond the graphic message to the user and community.
RESEARCH
Inspiration: Graphic Solutions

Figure 34.
PACM Security Sign

Figure 35.
Castle Law Sign

Figure 36.
Pinnacle Security Sign

Figure 37.
Custom Security Sign
RESEARCH
Inspiration: Graphic Solutions

Figure 38. Brinks Security Sign
Figure 39. Neighborhood Watch Sign
Figure 40. Automatic Alarm Sign
Figure 41. ADT Security Sign
The final source of design inspiration came from investigating the suburban neighborhood landscape firsthand. There was value in traveling around a neighborhood and taking observations about the common objects that were found in plain sight.

Besides the graphic security signs that are often placed in the front yard, I also discovered that the majority of the homes had lampposts with address numbers (see fig. 42). This combination was logical for homeowners; it provides a means for other people to easily locate the home and scatters light during the late hours of night for people to find their way to a front door. This also coincided with security professionals recommendations, which stated that exterior lights and visible house numbers are an important tactic to deter criminal activity.

Figure 42.
Typical Lamppost
Looking for additional references and images, I located a photo of a suburban neighborhood yard that quickly summed up my research and solidified my thoughts on this source of inspiration.

The image depicts a lamppost towards the front of a home, while at the base sits a graphic security system sign (see fig. 43). This simple combination of two objects made a clear picture to anyone who walks past at anytime of day or night. If any potential perpetrator considered breaking in, it was very clear that the homeowner wanted to display they were protected by a security system long before anyone would reach the front door of the home.
After careful consideration from multiple areas of research, I developed a conceptual system that would successfully attempt to solve my initial problem of psychological security. These conclusions were deducted from review of statistical data on burglaries, alternate tactical security solutions, combined with the definition of “threshold,” and the inspirations from; nature, present day graphic solutions, and the suburban landscape objects.

The main objective of this design is to create a sense of emotional safety to its user and simultaneously send visual signals that can cause emotional intimidation to a potential criminal. The final product causes duel emotional states, wrapped into a single package.

The Threshold object required a functional system to achieve a common purpose. The visual aesthetics had to be cohesive, so that all people could understand its purpose, react to its various states, and most importantly feel its psychological impact. The system would be designed around the lighting conditions, similar to the response of the Atolla Jellyfish when under threat.

The security system and resulting product is called Threshold. There are additional constraints that Threshold must overcome to be successful in its various goals. First, it must function physically to protect a home from invasion. Second, its presence must provide people who have good intentions to feel emotionally secure, while intimidating a person with bad intent. Third, the product must adapt to users lifestyles and work in synchronization with systems that are already in place at the home and in the community. Fourth, the main object of the system must take careful consideration of aesthetic detail and fit into a suburban environment without drastically changing the landscape.

The Threshold system must be commercially viable and function by creating specific emotional responses to two user groups; homeowner and perpetrator.
To understand what the Threshold system is and how it actually functions, two opposing scenarios needed to be created for its use.

**Scenario Group A:**
The non-threatening condition: A friend, postal worker, delivery person, etc. approaches a home in a suburban neighborhood. As they increase their proximity to the home, so does the increase and intensity of white light on the Threshold system. If they back away from the property the light responds in the same fashion, by decreasing in intensity of white light. Should the homeowner enter or knowingly let someone in, the Threshold system would momentarily signal with a green flash of light, acknowledging that the house was acceptably safe and the light could return to its default state.

**Scenario Group B:**
The threatening condition: A person who approaches the home with the intent to commit a crime would have the identical experience as our previous user, Group A. As they increase their proximity to the home so does the increase and intensity of white light on the Threshold system. This provides anyone in the neighborhood with instant visual feedback that someone is approaching. If they react and are threatened by the thought of law enforcement arriving, they still have the option to back away from the property. The light will respond in the same fashion, by decreasing in intensity of white light. Should they continue to carry out a crime and enter the home unlawfully, a red light is activated on the Threshold system and parallel Threshold systems in the vicinity (on other homeowners’ properties in the community) flash yellow alerting the community where a crime is being committed. Law enforcement can be contacted by those in the community as well as automatically summoned by the system that is on a red light status signal. The various red and yellow light signals also serve the purpose to help law enforcement quickly locate and target the home where a crime is occurring.
Using the proposed system solution and scenarios, work began on conceptualized designs. Putting sketched ideas visually on paper helped to flesh out the product itself. Starting to re-imagine the lamppost by creating silhouettes was helpful (fig. 44). The concept behind this rough sketching exercise was to create a form that would work cohesively in the suburban neighborhood landscape, while proclaiming its presence. Initially it looked like the object at the heart of the system should visually show power and stature over an
individual before they approached. This idea was found to be too extreme once modeled in physical space. The idea evolved by evaluating the user needs further, but the benefits of the product height would remain as a valuable tool. The object needed to be viewed from far off distances to be effective.

Further concepts involved adding pitch to the product silhouettes (see fig. 45-47). The formation of this angle demonstrated a desire for the product to reach out into the street / community or an individual who was curious about investigating the home. This was also important in allowing police to easily locate the home.

Using the inspiration found from the Atolla Jellyfish and bioluminescence, determinations were made on how and where light could be used as an alarm response (see fig. 48-50). The forms investigated the shape that light could distribute, creating the various informative, illuminated states of the system.
Additional concepts included a physical object that would move, articulate, spin, expand, and display light at different brightness’s (see fig. 51-55). The forms of the box, cylinder, and cone were used to follow the aesthetic concepts of simplicity, especially when it came to manufacturing.

The form ideations eventually returned back to the style of a typical lamppost that can already be purchased by consumers on the market (see fig. 56-59). The realization that users might not adapt or want a strange object in their yard drove these final sketched concepts. A tall lamppost that would feature intelligent lighting and legible house numbers was more along the tone that I hoped to adhere to, as the design was conceived.
Figure 56.
Sketch 13

Figure 57.
Sketch 14

Figure 58.
Sketch 15

Figure 59.
Sketch 16
In addition to hand sketches, physical ideation models were simultaneously being constructed to get form into a physical space using available resources. The use of cardboard and tape was the quickest way to investigate three-dimensional forms.

Early concepts explored anthropomorphic robots that would greet individuals through speech and sight (see fig. 62). While other designs investigated how light could be manipulated through a typical iris lens found on a camera (see fig. 60-61).

These concepts did not satisfy the user or system requirements that were laid out in for the Threshold system. It was important to create these designs to verify that they would in fact fail in future testing.

Along the lines of angular columns, several models were made to explore octagonal forms to represent the symbol of a stop sign (see fig. 63-65). The octagon was also important when considering manufacturing needs. The straight, eight-sided figure was much easier to maintain and construct in appropriate materials.
Some models were constructed to specifically explore the use of movable parts and the practicality of using such systems a real environment (see fig. 66). These models proved that mobile parts provided too many opportunities for the product to fail or be tampered with when operational. This study went on to prove that a static, non-moving product would need to function with other types of reactive, visual, and optical states.
Figure 66.
Model 7
Using computer aided design proved to be a good next step in forming the details that sketching and physical models could not accurately depict. This process was important for understanding the manufacturing methods that an individual or company would have to take to create a functioning prototype.

Several computer model solutions were designed to be a thick, heavy, octagonal column (see fig. 67). This design prevents the object from being tampered with or moved. The light source is reflected upwards and a slot on the side informs the individual about the state of the system.
Another set of designs took inspiration from a lighthouse (see fig. 68-69). The tall angular structure allows for maximum lighting to be seen as a beacon. After careful review this structure used and wasted too much material to be cost effective in a real world-manufacturing scenario.

Figure 68.
Computer Model 2

Figure 69.
Computer Model 3
The design solution that would ultimately meet all my criteria for the Threshold systems was a tall, octagonal structure that holds eight LED light bars, around a central column (see fig. 70). The top leaves room to display house numbers, but the design ultimately needed refinement to get to a finished state.

Figure 70.
Computer Model 4
The final design of the Threshold (see fig. 71) light monitor was developed from a thorough process of investigation through sketching, model making, and computer design. The monitor itself stands seven feet tall with a twelve-inch octagonal diameter. More than half of the object is made from the reactive light that will produce specific and designated signals (see fig. 72-75). The top clearly displays the house numbers for easy location finding, while the two foot tall base can house important internal components and maintain structural stability.
Figure 72.
Final Design “Active”

Figure 73.
Final Design “Red Alert”
Figure 74. Final Design “Yellow Alert”

Figure 75. Final Design “Green Alert”
The Threshold system provides an innovative security light monitor for each individual home in the suburban neighborhood and community (see fig. 76). Acting as an intelligent group, each monitor actively watches over your home and your neighbors’ homes 24 hours a day, 7 days a week.

As an individual approaches or leaves your property, your security monitor light will change in luminescence relative to their proximity. Should someone attempt to break-in, you, your neighbor, and law enforcement will be immediately notified by the lighted response and activation of your Threshold security monitor system.

The Threshold replaces your present day lamp and address number post in a typical suburban front yard, allowing for clear visuals to members of the neighborhood and law enforcement officials (see fig. 77).
DESIGN SOLUTION
The Product and System

Figure 77.
Threshold At Home (detail)
The Threshold light monitor system can display four main states while active. Each is unique to a specific situation, but universal in design and understandable in concept.

Day or night, the default state for the light monitor is always displayed at a 10% white light. The light itself fluctuates in what could be termed as “breathing” by dimming on and off while functioning in a passive mode (see fig. 78). As an individual approaches the property, the light changes into an active mode. The active mode tracks a person in relation to their vicinity to the home, and responds by changing in brightness of light.

A static red alarm alert light at 100% brightness, informs that an individual has used forceful entry to gain access to the home. Local authorities have been notified and law enforcement will arrive to investigate the cause of the alarm (see fig. 79).

A consistent flashing yellow alarm alert light at 100% brightness, informs that an individual has used forcible entry to gain access to one of your surrounding neighbors’ homes. Those in the neighborhood should be vigilant and contact law enforcement to report suspicious behavior (see fig. 80).

A single flash of green light at 100% brightness alerts that a homeowner has entered or let an authorized individual into their home. All is considered safe, and the light monitor will immediately return to its default state (see fig. 81).
Figure 78. Display White Alert

Figure 79. Display Red Alert
Design Solution
Display States

Figure 80.
Display Yellow Alert

Figure 81.
Display Green Alert
Other considerations were made while designing the system including creating a graphic logo, branding strategy, and additional visual decisions that were needed for the potential launch of the system.

The Threshold logo (see fig. 82) was important to the overall design, demonstrating the product’s potential strength. It uses a bold capitalized typeface as well as the graphic replacement of the “O” with an octagon to signify a stop sign and represent the physical footprint of the product.

As subtext, the logo is also shown with the phrase “Neighborhood Security System” (see fig. 82). This vernacular selection is meant to show a clear distinction from other security systems on the present day market, which do not attempt to secure the neighborhood as a whole.

An additional tag line that is used in visual communications, states: “Home Protection Through Your Community.” Following the style of the logo and subtext, this tag line is additional support for the system functions.

The selection of color (see fig. 82) was not haphazard, but selected out of psychological needs. Various sources suggested that blue is considered to be a trustworthy, honest, and loyal color. It exhibits inner security, confidence, and can be relied on to take control during difficult times. It was the logical color to use in my designed branding and marketing tools.
The Threshold light monitor is produced from bent and welded steel on the weatherproof cap. It is customized to display large reflective address numbers at the front. The light is produced from transparent RGB LED light rods, which are supported on top of bent and welded steel base. The base, embedded in concrete, also houses electrical components and sensors (see fig. 83). The use of these materials and manufacturing methods is time tested in many outdoors applications and provides strength in adverse weather conditions.
Using multiple proximity sensors around the home, either ultrasonic, RFID technology, or infrared, an individual approaching the home can be immediately and accurately tracked. The graphic (see fig. 84) depicts the percentage of light that the Threshold system will produce as an individual approaches the home. The intensity of light begins at 10% from the furthest boundary, up to 100% at the immediate exterior of the home.
My next phase of design was to bring the Threshold system to life for user testing and prototyping. Working with local RIT resources at hand, I developed several “looks like, feels like, and responds like” models. These proof of concept mock-ups were low budget and minimal technological solutions that accurately demonstrated the system.

The first step in prototyping involved building the physical Threshold lamppost monitor to achieve the proper footprint and scale. I constructed the monitor using MDF board, plywood, steel pipe, clear acrylic panels, and various pieces of cabinet and plumbing hardware.

Prototyping the octagonal base was a challenge; each side had to be cut at the proper angle and then attached using grommets and wood glue (see fig. 85). Plumbing hardware was used to secure the main steel column pipe to the cap and base. The base was purposefully designed to allow for electrical wiring to pass through and sensor technology to be installed. Once constructed the unit was spackled and sanded to a smooth finish in preparation for final paint (see fig. 86).

The final octagonal Threshold monitor stood at seven feet tall with a two-foot tall base. The overall unit weighed less than 100 pounds, most of which was in the base, maintaining overall stability (see fig. 87).
USER TESTING
Mock-Up: Physical Model

Figure 85.
Prototype Construction

Figure 86.
Prototype Sanding

Figure 87.
Prototype Assembly
The first technological solution to the reactive lighting system was very basic. The initial customized prototype was constructed from typical electrical hardware (see fig. 88). Using light bulb fixtures and electrical wiring, I created a system of CFL colored lights attached to individual switches. The three colors represented a particular system state, but each had to be manually turned on or off to display the desired effect (see fig. 89). A white LED dimming light bulb was also wired to a manual dimmer switch, which allowed for simulating the reaction of the Threshold monitor when a person approached the area of a home. This panel was placed inside the Threshold monitor case to test for distribution of light and emotional reaction.
USER TESTING
Mock-Up: Technological Solution

Figure 89.
Initial Lighting Tests
To further prototype the light monitor and achieve a more even and consistent light, I worked to create a system that functioned on a proximity detector and dimmable LED lights. Restrictions in the availability of technology would prevent me from showing all desired states of the system. I opted to show the most important variant of the system, the white light that would inherently cause a psychological reaction to the users.

Devising the new lighting system required me to seek professional knowledge. Working with electrical engineers and computer programmers, I created a complex system of sensors, microcontrollers, servos, dimmer switches, and dimmable white LED lights to emulate an accurate system as envisioned.

The system was controlled by a single Arduino microcontroller with customized code installed (see fig. 90). An ultrasonic distance range finder sensor was attached to the controller board, and programmed to ping sound waves in front of the Threshold monitor (see fig. 91). If an object was detected in the range of the sensor, a signal was sent back the Arduino with a numerical distance value. Based on that value, the Arduino board would output a secondary signal to a servomotor in relation to that number (see fig. 92). The closer the object was, the more Arduino would tell the servo to increase in clockwise rotation. This also functioned in the opposite fashion, the further the object was, Arduino would tell the servo to increase counterclockwise in rotation. The servo was then manually chained via rubber o-ring, to a 270 degree rotational dimmer switch (see fig. 93). The rotational dimmer switches output, was connected to white LED flexible lighting strips, which were powered in a series with help from a 12V DC 12.5A 150W regulated switching power supply. The LED lights were attached to eight half round clear acrylic rods (see fig. 94-96).
USER TESTING
Mock-Up: Technological Solution

Figure 90.
Arduino Microcontroller

Figure 91.
Ultrasonic Sensor

Figure 92.
Servo

Figure 93.
Rotational Dimmer Switch
USER TESTING
Mock-Up: Technological Solution

Figure 94.
Final Electrical Set-up

Figure 95.
Case Installation

Figure 96.
LED Lights and Acrylic Rods
The final prototype model was painted in matte black paint, emulating the look and feel of the metal powder coating process on steel. House numbers were screwed onto the front panel of the cap as a location marker (see fig. 97). The acrylic rods were inserted into the base and cap to cascade light against the polished steel support pipe. The LED lights were attached to their corresponding power supply and microcontroller in the base of the unit.

The system functioned as intended once properly installed and positioned. The ultrasonic sensor could read a maximum distance of approximately six feet in front of the unit. Regardless of the distance, as a person approached or retreated, the correlating amount of ambient light projected from the object and would change to match their distance (see fig. 98).
USER TESTING
Mock-Up: Final Model

Figure 98.
Threshold Monitor, Final Prototype
The graduate thesis show was held at the Rochester Institute of Technology’s Bevier Gallery on March 25, 2013. The Threshold system and monitor were unveiled for public feedback and reaction (see fig. 99).

In addition to the physical Threshold monitor prototype, three graphic posters accompanied the project for further explanation. A marketing poster was designed to reflect the potential commercial feel for the product (see fig. 100). A second poster discussed the system details (see fig. 101). And the third poster described the thesis concept, background, and brief research that supported the final outcome (see fig. 102).
Figure 100.
Marketing Poster

**THRESHOLD**
NEIGHBORHOOD SECURITY SYSTEM

**HOME PROTECTION THROUGH YOUR COMMUNITY**

THE THRESHOLD SYSTEM PROVIDES A STATE-OF-THE-ART SECURITY LIGHT MONITOR FOR ALL HOMES IN YOUR COMMUNITY. ACTING AS AN INTELLIGENT UNIT, EACH MONITOR ACTIVELY WATCHES OVER YOU AND YOUR NEIGHBORS’ HOMES 24 HOURS A DAY, 7 DAYS A WEEK.

**HOW IT WORKS**
AS AN INDIVIDUAL APPROACHES OR LEAVES YOUR PROPERTY, YOUR LIGHTED SECURITY MONITOR WILL CHANGE IN LUMINESCENCE RELATIVE TO THEIR PROXIMITY. SHOULD SOMEONE ATTEMPT TO BREAK IN, YOU, YOUR NEIGHBOR, AND LAW ENFORCEMENT WILL BE IMMEDIATELY NOTIFIED BY THE LIGHTED RESPONSE AND ACTIVATION OF YOUR THRESHOLD SECURITY MONITOR SYSTEM.
Figure 101. System Details Poster

Threshold System and Security Monitor

The Threshold System is designed to be a substantial neighborhood-wide security system, with the ability of discouraging criminal behavior on a homeowner’s property. As a group, each homeowner will agree to the neighborhood-wide installation of a personal Threshold security monitor to guard their home and to proxy the community as a whole. Each completed phase of 367 protection and immediate response of law enforcement.

The physical components of the Threshold security monitor are relatively simple and produce a great impact. Constructed from weatherproof materials, the monitor can survive all types of harsh climates. Large reflective custom address numbers allow for friends, family, acquaintances, and law officials to easily locate your home. The monitor’s height and clear LED light ends make an invisible perimeter which allows the monitor to not be overly dominant in your environment. All electrical components are housed in a steel and concrete base, while the proximity sensors are located around your property.

Proximity Detection

The Threshold security monitor serves any and all individuals approaching your home through a network of proximity detectors placed around your property. By default, your monitor will automatically provide 100% bright white light to diminish your property. As an individual increases their approaching distance to the house, the security monitor gradually increases in the intensity of white light until it reaches an illuminated state of 100% brightness. In similar fashion, once an individual travels away from the house, the Threshold security monitor will react by decreasing in the intensity of white light.

There is no need to fear the Threshold security monitor’s lighting functions. This function acts purely as a way to take watch over simple actions in, or around your property. The neighbors, mail carrier, or visitors will be greeted by having their path lit brightly with a welcoming light.

Should an unknown individual approach, they will also be illuminated by the increase in light for you and your neighbors to watch and determine if an act of burglary or unusual behavior is taking place.

Reactive Display States and Alerts

The Threshold security monitor has three different warning states that can be triggered. The lighting changes are displayed upon the paterns and intentions of an individual who approaches your property activating the proximity lighting system. Each individual state calls upon a different and unique function based on the severity of the alert.

Red Alarm Alert Light: An individual has used forceful entry to gain access to the home. The authorities have been notified and law enforcement will arrive to investigate the cause of alarm.

Yellow Alarm Alert Light: An individual has used forcible entry to gain access to one of your neighbor’s homes. Stay in your home, lock the red alarm light, be vigilant, and contact local law enforcement to come to your neighborhood.

Green Alarm Alert Light: The homeowner has entered or let someone into their home, all is safe and the monitor will return to its default state.
HOME SECURITY: 
THE PSYCHOLOGICAL THRESHOLD

CONCEPTUAL SPARK
In the fall of 2014 my father was victim to the COI incident that you have heard about in your class. My mother was alone at home when my father was attacked and injured. The incident occurred in a highly visible and well-lit area.

My mother was shocked and devastated. The attacker was a stranger and my mother was left psychologically affected by this event. It is due to the lack of safety in our marketplace and neighborhoods that this event occurred.

PROBLEM DEFINITION
Existing suburban neighborhoods have not been designed for protection with the specific needs of crime prevention and personal safety. A review of design strategies and home security systems presented solutions that successfully reduce home invasion in a community.

FACTS
- In 2014, a state of 3.5 million households are victims of crimes in the United States. Over 40% of these crimes are residential break-ins.
- In 2011, the FBI crime victim statistics show there was one burglary every 14 seconds in the United States.
- $27,700 is the average cost per household in the United States and insurance policies do not cover all losses.

SOLUTION
My solution intends to improve the security of existing suburban neighborhoods. I invented the concept of a psychological threshold that will trigger a response from the homeowner.

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ABOUT THE DESIGNER
David Strauss holds a Bachelor of Fine Arts degree in Graphic Design from Edith Moat College. He is currently pursuing a Master of Fine Arts degree in Industrial Design at Rochester Institute of Technology.

INSPIRATION
Inspiration was drawn from my research and personal experiences. This project was inspired by the psychological threshold that I discovered in my research.

ACKNOWLEDGMENTS
- My heartfelt thanks to the Industrial Design program and all the people who have contributed to this project.

FUTURE CONSIDERATIONS
In addressing any security solutions, intricate projects require a considerable amount of detail and planning. Some of these projects include:

- Home Invasion: A Psychological Threshold
- The Perception of Risk in Security Systems

Committee Members
- Brian Michel, Associate Professor
- RIT Industrial Design
- W. Morrisey Harris, Associate Professor
- RIT Industrial Design
- Susan H. Harris, Associate Professor
- RIT Industrial Design
- Laura Ann Young, Assistant Professor
- RIT Industrial Design

Home Security: The Psychological Threshold

Figure 102.
Concept Poster
The working Threshold monitor prototype was on display both in the RIT Bevier Gallery and around the RIT industrial design studio for several weeks. I was able to analyze the Threshold system and final resulting product during this phase of testing. These discoveries helped to reinforce my design concept and system solution.

During this period of user testing, I observed people of all ages interacting with the Threshold monitor. They often times went through the same series of reactions because of the informal environment in which the system was placed.

The first reaction was curiosity; users wanted to get close to the structure to determine what it was and why it was there. The next reaction was discovery; users noticed that the light changed the closer and further away they got from the Threshold monitor. The final and third reaction was play; users moved back and forth to change the effect of the light, often times trying to trick the system or make it function differently by using their bodies.

The overall height of the product helped to attract users over to investigate it, while most users did not have to be persuaded of the objects potential reality. The house numbers, as well as similarities to a typical household lamppost, and marketing tools left little doubt that the Threshold system was a believable object for the suburban landscape.

Due to the limits in available technology, the system tests for the alert stages could not be conducted for a large or varied user group.
CONCLUSION

D. Strauss (2014)

The Threshold system is a new, innovative design solution that has not been tried in a suburban neighborhood before. The conceptual design works both in theory and practicality in small scale tests.

By using design thinking I have attempted to create a new approach on security beyond the suburban homeowners’ immediate property. Using the communities involvement reaches back into an era when neighbors typically looked after one another more actively. The system makes a technological bridge across a social gap in our present day society where people are not as communicative with each other in a face-to-face way. Securing the entire neighborhood as a whole is a new approach to ones individual home security, going beyond the typical gated communities that can be found. Using light as a universal signal to affect psychological responses speaks to people of all backgrounds. Most importantly the Threshold system provides a new sense of psychological security to the occupant of a home, and psychological intimidation to criminals who would want to break the now larger threshold environment of the neighborhood.

Although this conceptual product has not been tested on a neighborhood wide scale yet, this first generation design accomplished and clearly met my initial goals and requirements. The system could unquestionably prevent or discourage a perpetrator from approaching a home, and would signal a crime to the surrounding community, should one take place.

Understanding the human condition of psychological thresholds is necessary for the future potential of increased home security.
CONCLUSION

Future Refinement and Considerations

Based on verbal user responses and testing analysis, I have developed additional and future design considerations. The following ideas would need to be addressed to increase the success of the present system design.

The first consideration is for the addition of a sound component when the system goes into a red alert. Early designs included a location for a speaker, but were later dropped so that the emphasis into light could be more deeply explored. Looking into the frequency, range, volume, and types of sound would be necessary to compliment the visual components. The monitor would only need small modifications to include space for a speaker and its components.

Alerts for other types of emergencies on the light monitor would be helpful for way finding in the suburban environment. Additional lighting states would easily be added to the system with the entire spectrum of light and eight separate light bars available for use. For instance if a household needed medical assistance, the light monitor could show the color blue alerting medical personal where a particular house is on the block. In a similar scenario, fire services could also use this system to cause the light monitor to strobes, allowing rescue personnel to locate the house more effectively. The monitor could also be used for general communications. For example, if a service or delivery professional cannot locate your home, a manually flipped lighting display could be switched to the color purple guiding that person to the property.

Many users requested aesthetic choices for the light monitor component allowing them to fit the many different appearance of their homes. Without modification to the system components, the Threshold could simply be skinned for multiple different facades as needed.

There was also a necessity for choice on who the Threshold contacts in the case of an emergency. If required the Threshold could allow for a private security firm, local neighbor or friend to be contacted first. The ability to customize this option would need to be included in a software package.
CONCLUSION

Future Refinement and Considerations

The method for installation of the Threshold monitor also needs to be addressed further. Depending upon manufacturing methods it may be possible for homeowners to set up the unit themselves. It is not out of reach to believe that a local government department or contractor might need to install the unit, similar to the installation of a hard wired lamppost found on today's market.

Testing for different lighting conditions during adverse weather or bright days would need to be conducted. I’m confident that using increased light quality and technology, would overcome any issues during this phase.

The in-home components of the Threshold system must be designed to be complimentary to the light monitor and more importantly easy to use and understand. A close study of ergonomics and ritual would help to define a new series of problems to solve. Given the current landscape of smart mobile phones, it could be conceived that the interactive home component application could be accessed directly from the customers’ mobile device.

The system was designed to be located in a specific environment and therefore functions at its highest capacity in the suburban neighborhood. Scaling the system up or down to meet the needs of urban and rural environments would help to fill the gap between these locations.

Finally, there is no off button on the Threshold system. Homeowners could carry a unique RFID signature in a mobile phone or house key that allows them to walk around their property without constantly activating the system functions. This could help to prevent potential user error or annoyances.

There are many more future refinements to embrace and ponder as technology transforms but one constant remains; the hope of increased home security through the Threshold system.
CONCLUSION
Modern Day Scenario

On April 15th 2013, one month after my thesis show, two domestic terrorists bombed the marathon in Boston, Massachusetts. This horrible act forced the entire suburban neighborhood of Watertown, just outside of Boston, to shut down for 24 hours. An intense manhunt for the suspects occurred while a “shelter-in-place” advisory was in effect for the community. Law enforcement officials attempted to search every area of the neighborhood to effectively locate the bombing suspect. It took the help of a vigilant homeowner to track the suspect down in a backyard, where a boat was being stored (see fig. 103-105).

After watching this event unfold in the media, I immediately made a connection with my own design work on home security. I saw many opportunities where the Threshold system could have been a helpful solution to catching the suspect quickly and also aid in communications. The community and law officials would be able to connect via the security light monitors and information would be spread from the visual alert system. This event helped me understand the value in the continued conceptual development of this system for future use.

Figure 103.
Watertown, MA

Figure 104.
Inferred Images

Figure 105.
Bombing Suspect
The following code was used in conjunction with Arduino microcontroller to create a sonic sensor effect a servo that controlled a dimmer switch attached to LED dimmer switch.

```cpp
#include <Servo.h>
Servo myservo;
int pos = 0;
const int numOfReadings = 5;
int readings[numOfReadings];
int arrayIndex = 0;
int total = 0;
int averageDistance = 0;
int echoPin = 2;
int initPin = 3;
unsigned long pulseTime = 0;
unsigned long distance = 0;
int redLEDPin = 7;
int redLEDValue = 0;

void setup() {
  myservo.attach(9);
pinMode(redLEDPin, OUTPUT);
pinMode(initPin, OUTPUT);
pinMode(echoPin, INPUT);

  for (int thisReading = 0; thisReading < numOfReadings; thisReading++) {
    readings[thisReading] = 0;
  }
  Serial.begin(9600);
}
```

The following code was used in conjunction with Arduino microcontroller to create a sonic sensor effect a servo that controlled a dimmer switch attached to LED dimmer switch.
void loop() {
    digitalWrite(initPin, HIGH);
    delayMicroseconds(10);
    digitalWrite(initPin, LOW);
    pulseTime = pulseIn(echoPin, HIGH);
    distance = pulseTime/68;
    total = total - readings[arrayIndex];
    readings[arrayIndex] = distance;
    total = total + readings[arrayIndex];
    arrayIndex = arrayIndex + 1;
    if (arrayIndex >= numOfReadings) {
        arrayIndex = 0;
    }
    averageDistance = total / numOfReadings;
    if (averageDistance < 255) {
        redLEDValue = 255 - averageDistance;
    }
    analogWrite(redLEDPin, redLEDValue);
    Serial.println(averageDistance, DEC);
    if (averageDistance > pos) {pos=pos+2;};
    if (averageDistance < pos) {pos=pos-2;};
    myservo.write(180-pos*3);
    delay(150);
}
The following code was used in conjunction with Arduino microcontroller to create an automatic “Pulse” on LEDs by adjusting a servo attached to a dimmer switch, shown at my final thesis show.

```cpp
#include <Servo.h>
Servo myservo;
int pos = 30;
void setup()
{
    myservo.attach(9);
}

void loop()
{
    for(pos = 22; pos < 140; pos += 1)
    {
        myservo.write(pos);
        delay(20);
    }
    for(pos = 140; pos>= 22; pos-=1)
    {
        myservo.write(pos);
        delay(20);
    }
}
```
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