Litter Reduction from a Behavioural Science Perspective

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Executive Summary

Incorrectly disposed litter is a problem across the world. This report summarises some of the research which has been completed on the topic of littering. Its focus and recommendations are based upon the use of applied Behavioural Science.

Using Behavioural Science, the human behaviour of littering may be analysed and measured. Changes are then made to the environment and their impact is also measured. Using this methodology, changes which are successful at altering the behaviour of littering may be implemented more widely and further effort is not expended on unsuccessful interventions.

It is possible to make the behaviour of 'putting litter into a bin' more reinforcing than the behaviour of 'dropping litter' by using a combination of measures including, but not limited to: goal setting, providing and receiving feedback, introducing interesting and attractive litter bin designs, and engaging community members.

1. Introduction

This report is the result of research by academics in New Zealand, the UK and the USA and has been compiled by Lynn Dunlop who is the editor at Hollin Consulting.

It has been asserted that all the litter that we see in our environment is there because of somebody's carelessness, laziness or irresponsible attitude. Behavioural science suggests that the issue of litter may be tackled successfully. This report includes details of what various institutions have done to address the problem, and provides behaviourally-sound recommendations for responding to the litter problem.

2. Behavioural Science

Behavioural Science uses data analysis to come to conclusions about what people say and do, and how that is related to the environment around them. The core of behavioural science is objectivity, leading to a clear understanding of what behaviours are currently taking place in the environment. By modifying the local, external environment around people, we can achieve behavioural change.

One of the keys to sustaining a long-term changes in the environment is to implement behavioural science in everyday decision-making and design. Learning the basics of behavioural science allows one to quickly recognise what causes certain behaviours and how to change the environment in order obtain desired behaviours.

Behavioural Science Terminology included in this report

- **Antecedent –** An antecedent is a request, prompt, or condition which precedes a behaviour in an attempt to drive that particular behaviour. Antecedents are around 20% effective at changing behaviour.
  - o Example: Anti-littering signs, the presence of a litter bin or an education campaign in a school.
- **Consequence –** Consequences are what happens following a behaviour and have the greatest likelihood of changing future behaviour. When a consequence increases the likelihood of a behaviour taking place again in future it is known as 'Reinforcement'. A consequence whereby the behaviour stops is known as 'Punishment'.
- **Reinforcement –** A consequence that increases or maintains a behaviour.
  - o Example: Giving a person money in exchange for recycling their used bottles. For most people, this consequence increases the likelihood that the performer of the behaviour will return their used bottles in the future.

Positive reinforcement occurs when the performer of a behaviour does more of something because they want to, as in the bottle recycling example.

Negative reinforcement occurs when the performer's behaviour is maintained because they are looking to avoid the threat of an undesired consequence, like a possible fine: The performer is doing something because they feel they have to.

- **Punishment –** A consequence that decreases likelihood of future behaviour.
  - Example: A police officer delivering a fine to someone for throwing litter on the ground in a public park will be a punishing consequence if it reduces the likelihood that the performer of the behaviour will throw litter on the ground in the same area in the future.
- **Environment –** The environment is the immediate location of the performer of the behaviour, as well as what or who is in that location, including their behaviours. The environment will often provide the consequences which follow the behaviour.
  - Example: A person fly-tipping is more likely to carry out this behaviour when the local environment has fewer witnesses; perhaps at night, or by selecting an isolated environment to carry out the behaviour.

3. Littering from a Behavioural Perspective – A Consequence Analysis

Behavioural Science states that all current behaviours are being reinforced by something. It does not matter if the behaviour is desirable or not; if it is occurring then there must be a reinforcing consequence for the performer of the behaviour.

In the case of littering, we can analyse some of the possible consequences that may maintain the behaviour of littering by people:

- Throwing litter on the ground is quicker than walking to a receptacle.
- It is also easier; it does not require the effort to walk to the bin.
- The performer might see someone else dropping litter, or just see litter on the ground, and feel uncomfortable about using the bin due to peer pressure.

All of these consequences maintain the value of littering because they are reinforcing the behaviour for the performer in one way or another. All the consequences are reinforcing to the performer, happen as the behaviour is taking place, and are certain to follow the behaviour. By throwing litter on the ground, one immediately gains the time spent walking to the bin, immediately doesn't have to exert any extra effort, and immediately gets the feeling of fitting in with others who are also littering.

A punishing consequence such as a fine would be undesirable, and could be immediate, but is so uncertain to occur that it does not influence the behaviour. Never having encountered a punishing consequence for a behaviour in the past decreases the likelihood that it will be an effective deterrent.

In order to prompt the desired behaviour of disposing of litter in the bin, it is vital to change the environment so that placing litter in the bin has more reinforcing consequences and fewer punishing consequences than the behaviour of dropping litter.

As Behavioural Science is based upon objective data analysis, the first step is to gather baseline data.

4. Data Gathering, Setting Goals and Delivering Feedback

Data Gathering

Behavioural research relies on data in determining the success of the behavioural change. Therefore, before implementing any changes, the extent of the problem

must be objectively assessed. Once this has been done, an intervention may be implemented and the data gathered will truly determine its effectiveness. The data-gathering must be completed objectively and with an easily observable and unequivocal measurement. Examples of measurements that could be considered are:

- The weight of the litter from the litter bin compared to that on the ground within a set distance of that bin.
- The amount of visible litter in a designated area or areas. This would require pinpointing what constitutes 'litter'.
- Counting the number of times litter bins were used during a set time period.

It may also be useful to evaluate the demographics of people who drop litter and also to differentiate between, and measure, the nature of the litter being dropped; cigarette butts, chewing gum, drinks containers etc. (see appendix A).

Setting Goals

Once sufficient data has been collected, that information should be used to pinpoint a desired result. Results may be defined as the 'outcomes of a collection of behaviours'. For example, the result of "reducing litter in park grounds by 50% over twelve months" could be achieved by changing the behaviours of park-users, of park workers, of refuse collectors or a combination of these and other measures designed to alter people's behaviours.

Success in reaching the desired result must be evaluated based on a set goal. Making changes on a large scale requires taking small 'shaping' steps towards the result and it is vital to measure how successful any given change to the environment has been. Each change to the environment may only be deemed successful once the data has indicated that this is the case.

Goals should be constantly challenging but achievable. Failing to reach a goal is likely to be a dispiriting feeling which would be a punisher. Reaching a goal is more likely to feel like a positive reinforcer: a consequence which leads to more

discretionary effort as the performer wants to do more of the behaviour (in this case, achieving goals). By keeping goals small to begin with, and increasing them gradually over time, the desirable behaviours are more likely to be maintained in the long term. When setting goals, examine the data to determine the rate of behavioural change currently being achieved and set a goal that is just slightly higher than that (only a few percentage points to begin with). If it is found that the original goal is unachievable, it would be wise to re-evaluate it and set a more achievable goal.

Small successes lead to large change and meeting goals will aid progression towards the result and provide a sense of accomplishment for what has been achieved.

When looking to change behaviour, it is useful to set expectations by advising people of the baseline data and also of the new goals. It is then vital to continue provide information over time, or it will be felt that the instigators of the behavioural change are no longer interested in the change (this feeling is known as 'extinction'). The data could be published in local newspapers, at bus stops or it could be placed on the litter bin itself. This could be a goal-line placed on the bin to show the target amount of litter for that bin. Feedback and goal-setting both have some antecedent and consequence properties which make them ideal for maintaining behaviour.

Feedback

Delivering feedback is one of the most studied interventions in behavioural literature to date. It has been shown to be a highly effective part of delivering behavioural change; efficient and easy to use. By publishing the baseline data along with the goals, and continuing to make the data available over time, a new consequence is introduced into the environment. Showing people the results of their current behaviour is often enough of a consequence to prompt changes in their behaviour.

By removing any criticism of people's behaviours, and only providing objective data, it is less likely that the feedback will be received by the recipient as a punisher.

People who feel that they have been punished are less inclined to assist with the achievement of the goal.

By publishing the data as it changes, people are able to see how their behavioural changes have contributed towards achieving the goal; a reinforcing consequence which is likely to increase the chance of new behaviours recurring in the future. Keeping the feedback simple and easy to interpret is advisable: A 'before and after' picture, or a chart that people can glance at and see where they are would be ideal. The more individualised the feedback is, the more likely it is to be successful; so publishing results by neighbourhood may also be beneficial.

A behaviourally-reinforcing method for people to deliver feedback about littering would also be useful. Designing an 'app' (see appendix B) which is straightforward to use will provide reinforcing consequences and may engage people who might not otherwise take the time to get in touch. This could be used both for reporting littering, but also for soliciting suggestions for possible changes to the environment.

Examples of ways to provide and receive feedback include:

- Graphical representations of target litter-amounts (this could simply be a line on the side of the bin).
- Printed leaflets posted in shop windows or posted to homes indicating the progress made.
- Features in local press.
- A counter on a litter bin to indicate the number of items put into it
- A website for the anti-litter campaign.
- An interactive bin which makes noise, lights up or reacts in some manner when used.

5. Barriers to Success

Sustaining Change

In order to increase or maintain a behaviour, there requires to be a reinforcing consequence for the performer for carrying out that behaviour. In order to sustain behaviour over the long term, it is desirable that carrying out the behaviour becomes reinforcing in and of itself. Achieving this ideal will require trial and error, but it has been proven to be possible: The majority of people initially found wearing seatbelts to be a punishing consequence, but since seatbelt-use become a legal requirement, it has now become so much of a normal part of travelling in a car that many find it uncomfortable to travel without wearing a seatbelt.

Until a new behaviour becomes self-reinforcing, it requires constant effort to continue to provide consequences, both reinforcing and punishing. Even if great gains towards the result are made at first, more work will be required to continue making small changes and introducing new goals until the ultimate result has been achieved.

Cost

The cost of implementing changes to behaviour will vary depending on the nature of the changes to the environment. The costs are likely to include updating existing infrastructure, such as signs or litter receptacles and possibly of purchasing new infrastructure. It may also be decided that more people acting as "consequence providers" within the environment would beneficial. As it is imperative to continue to gather data throughout the entire implementation period of the behavioural change, any costs associated with this will be incurred. It is likely that in the long term, however, money will be saved as the behaviour of placing litter in the bin becomes more frequent.

Habituation

Habituation is the behavioural phenomenon wherein being exposed to the same stimulus over and over again causes there to be less of a reaction to this stimulus. Habituation can take as little as a few minutes to as long as several months, but should be taken into account when designing and implementing any intervention. This phenomenon may have several important implications in the context of reducing littering. For instance, the use of novel, brightly coloured or interesting litter bins can increase use of those bins (see appendix P). However, maintaining the novelty of the bins is likely to become necessary. Habituation applies to both antecedents and consequences, although consequences maintain their effectiveness longer. The use of a generally-preferred stimulus (such as money or social attention) may help reduce the effects of habituation in reducing the littering problem.

One possible solution in this context would be to create several different signs and litter receptacles, all with similar, but distinct, features (interaction with the person, different colours, and/or messages). Each sign and receptacle could then be varied based on their location. The signs with each receptacle could be varied as well, to provide multiple combinations. This may help avoid some of the habituation effects and produce a more stable change over time.

6. Littering Research

Research has been completed on a number of anti-littering campaigns from across the world as well as on relevant studies pertaining to behavioural change. Judging the relative success of the anti-littering campaigns is often difficult due to insufficient data being published to allow a comparison.

Of those campaigns that both gathered data and published it, the most successful included two "bin your butts" campaigns; one in Victoria, Australia and another by Keep America Beautiful (see appendices N and O). Both of these schemes targeted

a particular type of litter, cigarette butts, and changed the environment to make it more reinforcing for people to dispose of cigarettes butts in bins and more punishing for people to throw them away. These schemes are also notable as they target adults rather than children.

Another successful campaign is the long-running Don't Mess With Texas (see appendix B), which initially targeted 18-35 year old males and achieved a 72% reduction in litter on Texan highways between 1986 and 1990. This campaign leverages the pride that Texans have for their state and includes reinforcers such as an "adopt-a-highway" scheme, various social events to clean up litter and phone apps to make it easier (less punishing) to report littering.

Overt positive reinforcers such as reward schemes have been used in a number of research studies. In Seattle in the United States, a zoo rewarded patrons with a voucher for every ten pieces of litter handed to them (see appendix C). The scheme proved so popular that they were obliged to increase the number of litter items to twenty before a voucher was issued. The voucher was redeemable at a drinks kiosk on the zoo premises.

Reusable containers have been successful at reducing such litter in Germany, where cans, bottles and cartons handed back to a supermarket are redeemable for small cash sums (see appendix D). By adding a value to the items, it becomes more reinforcing to take them to a supermarket than it does to leave the items on the ground.

In Singapore, and in at least one research scheme, the possibility of a reward has been used to encourage people to dispose of litter in a desirable manner (see appendices E and F). At some Singaporean events, marked litter bags are handed to attendees. Filled bags returned to disposal points are entered into a prize draw. Similar research has been completed on marked litter during litter-picking events. Items marked with special paint are left around and the people who hand these in win a prize.

Negative reinforcers, where people carry out a behaviour in order to avoid something undesirable, have also been used successfully, although they are more likely to be successful when teamed with positive reinforcers. Examples of negative reinforcers include avoiding a fine and avoiding social ostracisation (see appendix G). In the latter example, as in Sweden, it is possible to make a litter-picking event both something that people are frowned upon for failing to attend, but also something that is a fun social event when one does attend. Thus, it provides both positive and negative reinforcement.

In Teignbridge, UK, a combination of positive reinforcers (the council installed more bins and cleaned the streets more often) and negative reinforcers (large fines were introduced for people caught littering) were used (see appendix H). Further to this, a community 'buy-in' was initiated whereby food stall and takeaway-shop owners signed up to become responsible for the cleanliness of the street next to them. The negative reinforcement of wishing to avoid 'standing out' by failing to sign up became a positive reinforcer for becoming part of a large social-acceptance scheme. Similar schemes were used in Paris, France (see appendix I).

The science explains that any behaviour that is currently happening is taking place because it is being reinforced. This is true of people outside the local littering environment as well. In Christchurch, New Zealand, as part of an anti-littering scheme within the school system, one of the activities is to pick up litter, sort it and then return it to the manufacturers who made the product with a letter asking how they will tackle litter in future (see appendix J). Currently, product manufacturers have overwhelmingly reinforcing consequences for ignoring the issue of litter. The litter is not outside their factory and they avoid having to complete research and possibly develop new solutions to tackle the issue. By delivering a new consequence to the manufacturers within their local environment (delivering the litter to their door) it is more likely that the behaviour of the manufacturers will be changed.

Prominent community members and volunteer groups have been used in various locations to aid in education and in cleaning projects (see appendices K and L).

Research indicates that a local individual who takes the time to engage community members and requests their participation in a new behaviour is more likely to succeed in changing behaviours than a leaflet or other method of communication (see appendix M).

7. A Behavioural Assessment of Previously-Attempted Interventions

Fines and increased law enforcement

A consequence which is uncertain to occur will be a less powerful driver of behaviour. Fines and law enforcement require to be a credible threat at the time someone decides whether or not to drop litter. If this is not the case, this consequence is unlikely to be effective on its own.

Shock and Awe – a public display of waste

This is an antecedent-only intervention that may provide rapid change, but only temporarily. This may be a good way to kick-start an anti-littering program, but additional interventions are likely to be required.

Working with local companies by offering special certification for giving out fewer bags or less packaging.

This is an intervention that is likely to help produce lasting change so long as the rewards are tied to some sort of consequence that is reinforcing for the participant (e.g. social recognition, reduced costs/fees).

Providing feedback

Allowing people to see how their behaviours are contributing towards a goal is a reinforcing consequence. It is vital that no 'blame' for failure be attached to the feedback as this would make the feedback more likely to be punishing instead.

Education of young people

At the time of the education, if the lesson is fun, the young people are likely to find reinforcement in the act of not littering. Away from the classroom environment, behaviours will naturally change as the environment changes: people around others who are littering are more likely to litter as well. Young people who are particularly moved by 'green' issues may find that keeping the planet clean is a more powerful driver of behaviour than the wish to 'fit in'. By engaging children and finding out what they feel are reinforcers for them, then using those responses as part of the lesson, it is more likely that education will be successful in driving behaviour.

Contests

The consequence of a possible reward for disposing of litter is powerful for both the people who win, and also for people who enjoy the experience of believing they may win (as with gambling). This consequence is very likely to maintain the behaviour of disposing of litter in a bin.

Creative bin designs

This may cause significant increase in proper litter disposal as long as the novelty of the bins is maintained by either rotating locations, or periodically replacing bins.

Litter-Picking Days

By marking particular days for litter reduction, the reinforcement of a social event could be used to instigate large-scale changes several times a year. If people find the consequences to be more punishing than reinforcing, however, this is unlikely to be successful in the long term.

Engaging volunteer groups

Volunteer group leaders and members may see litter-picking as both an educational opportunity for their group and as a 'good deed'. By removing any barriers to their participation, it is likely that the consequences of being involved will be overwhelmingly reinforcing for such groups.

Making more bins available.

Research[1] indicates that people are more likely to use a bin if there is one nearby.

Ensuring an area is tidy to begin with.

The Broken Windows Theory[2] suggests that if an area is well-kept to begin with, people are reluctant to be the first person to spoil this by dropping litter. As soon as the first piece of litter is dropped, however, others will follow suit.

8. Recommendations

Based on the current literature, the most behaviourally-sound approach is a combination of a number of the most effective antecedent and consequence conditions. This includes, but is not limited to, setting goals, providing feedback, using aesthetically pleasing litter receptacles, and providing reinforcement to prominent community members and groups for their co-operation. Only by using a variety of interventions to change the environment is lasting change likely to be achieved. A combination of measures is not easily found when searching in current interventions being used by government or in research.

Setting goals

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[1] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1297784/
[2] http://www.manhattan-institute.org/pdf/_atlantic_monthly-broken_windows.pdf

By setting achievable and well-defined goals, and celebrating when those goals have been achieved, a constant stream of reinforcement can be provided.

Providing and receiving feedback

By making it easy people to make suggestions for things to change within the environment, it becomes more reinforcing for them to both report littering and also to prompt new ideas that others may not have had.

Aesthetically-pleasing litter bins

Using novel and interesting bins, teamed with measures designed to reduce habituation, is likely to increase the use of those bins.

Engaging the community

Coordinating efforts against litter with a group of this nature would be mutually beneficial. Additionally, these groups might be interested in making or maintaining novel litter bins.

9. The Next Steps

We recommend that one should begin tackling the issues associated with littering by analysing the environment as it is at the moment. An example of this process is in appendix A. Gathering data on current littering behaviours and demographics, existing bin locations and waste collection, and on third party stakeholders and community partners allows you to set a baseline on which to build your efforts.

Detailed analysis of this data is likely to indicate that there is a particular area on which efforts may be concentrated; this may be a geographical area, a type of litter, a particular age group or some other factor. A review of the results suggested by the data will provide a starting point.

In our experience, anonymous surveys of stakeholders in any process will bring useful results; we recommend surveys of people who are involved in the littering process are carried out. These should involve local government, members of the public, refuse collectors, shop owners, park wardens and anyone currently working on anti-littering projects. As many different views as possible should be sought and the data carefully analysed.

With the information gathered, changes to one part of the environment (such as a particular park) may be implemented and further data gathered to assess its effectiveness. This process should be iterated until the data indicates that an improvement has been seen. Further small changes should then be made and all of these steps re-iterated.

10.   Conclusion

Although the barriers to success may appear high, making the consequences for disposing of litter correctly more reinforcing than punishing is possible.

The recommendations suggested in this paper are a starting point from which a successful litter-reduction program can be built. Although a significant amount of effort will go into starting and maintaining such a program, the results should make the endeavour worthwhile.

Setting achievable goals and making changes based on that data, and on feedback from community members, will be vital to the success of this project. By being creative with suggestions for changing the environment, measuring the results of the those changes and then trying something new, a successful program can be achieved with small steps.

11.   Appendices

<u>General Littering</u>

Appendix A

The Victorian Litter Action Alliance (VLAA) have done extensive work investigating the specifics of their litter problems and produce an annual litter report (Victorian Litter Report[3]) to measure progress towards their target of reducing littering behaviour by 25% by 2014. They monitor litter using item counts in square meter radii in different locations. Particular problem litter types, such as cigarette butts, beverage litter or confectionary litter are identified. They also monitor the rate of public littering, calculating the amount of litter in bins and the percentage of litter on the ground to calculate their littering behaviour rate. The VLAA have identified the important factors in reducing litter as context (sense of community), facilities and perceptions.

Litter Prevention Performance

- Litter Prevention Performance is scored out of 100 and tracks improvements to public places – for example, design and maintenance that may influence public littering and bin use. The higher the score, the better the performance.
- In 2010, Victoria scored 77/100 (up from 75/100 in 2009 and much improved from the 2007 score of 69/100). This year's litter prevention performance score exceeded the target set for 2010 (74/100) and represents a 20.3% state-wide improvement since litter assessment began in 2003.
- The Litter Prevention Performance score for urban areas in 2010 was 75/100 (up from 74/100 in 2009) but less than the regional score of 80/100 (up from 76/100 in 2009), which may reflect stronger community identity and involvement in smaller regional communities.

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[3]http://www.litter.vic.gov.au/resources/documents/Litter_Prevention,_Litter_Enforcement_and_Capacity_Building_Survey_Results_2011.pdf

- The 2010 findings reflect improved scores for general cleanliness of public places, including less illegal dumping and graffiti, as well as improved bin design, position and servicing, better landscaping, maintenance and cleanliness of street furniture.

Ground Litter Counts

- Litter Counts record the number of littered items found in a 48 square metre area of a public location.
- The average ground litter count increased to 36 items in 2010 (up from 32 items in 2009 but still well below the year of the worst litter count average of 54 items per location in 2007).
- Although this year's ground litter count has not lived up to the benchmark set in 2009, it is still well below the target set for 2010 (42 items per location).

Litter hot spots

- Urban areas scored higher for litter counts (averaging 40 items in 2010) than regional locations (averaging 27 items in 2010), although urban litter counts have generally been consistently higher than regional areas since 2003, perhaps reflecting stronger community pride in the regions.
- The worst location for litter on the ground is the public space immediately outside railway stations, which indicated an average of 118 items per location in 2010 (more than double the 58 items found in 2009).
- Although litter left behind at events decreased to an average of 28 items in 2010 (down from 53 items in 2009), the rate of public littering at events increased from 29% in 2009 to 48% in 2010, suggesting that people at events choose to litter rather than use bins.

Problem litter types

- Cigarette butts are the most common type of litter, accounting for at least half of all items counted in both urban and regional locations. This is followed by beverage items and then paper.

- Cigarette litter increased to 50% in 2010 (up from 47% in 2009) and represented the highest proportion of litter counts at smoking sites; 78% in 2010 (up from 68% in 2009). Cigarettes also featured prominently as a proportion of ground litter counted in 2010 at beaches (62%), events (58%) and at public building sites (59%).

- Beverage litter has increased steadily from 16% in 2005 to 31% in 2010, most of it in the form of glass bits. Although plastic and glass bottles represented less than 2% of beverage litter counts in 2010, glass bits made up 56% and metal and plastic caps and plastic bits made up 31%.

- Paper litter decreased to 7% in 2010 (down from 9% in 2009).

- Confectionary – lolly and ice cream litter decreased to 3% counted in 2010 (down from 5% in 2009).

Rate of public littering

Littering behaviour in 2010 was assessed by monitoring 734 litter disposals in 216 locations to calculate the percentage of litter not disposed of into a bin (or the Littering Behaviour Rate). Direct comparisons with littering behaviour in 2009, when conclusions were based on just 406 litter disposals, should be approached with caution.

- The 2010 results reveal that only 65% of Victorians are disposing of waste into bins in public places.

- The 2010 public littering rate of 35%, however, although higher than the target of 21%, is on par with the 2007 result of 31% and the 2005 result of 30%. This indicates that the rate of public littering appears to be trending upwards (rather than down as indicated by the 2009 benchmark of just 16%).

- Despite higher rates of public littering in 2010 compared with 2009, littering decreased in 2010 in malls (down to 25% from 27% in 2009) and at landmark

locations (down to 11% from 12% in 2009). Large increases in public littering were observed in park locations (up from 4% in 2009 to 19% in 2010), public buildings (up from 16% in 2009 to 87% in 2010) and events (up from 29% in 2009 to 48% in 2010).

Unfortunately, the result of the Victorian Litter Alliance monitoring shows that the littering rate is trending upwards in the sites monitored. While litter counts help to build a picture of litter accumulation in public places, what people do with unwanted items remains the most effective indicator of public littering and the most accurate measure of success in prevention efforts.

Appendix B

Don't Mess with Texas[4]

"Don't Mess With Texas" was originally a Texas Department of Transportation slogan that first appeared in January 1986 to discourage littering and has since been labelled the 'most successful anti-littering campaign'. The phrase "Don't Mess with Texas" was displayed on road signs on major highways, television, radio and in print advertisements. The campaign is credited with reducing litter on Texas highways roughly 72% between 1986 and 1990, and is still being used now. The campaign's target market was 18-35 year old males; statistically shown to be the most likely to litter. While the slogan was originally not intended to become a state-wide cultural icon, it did. Beyond its immediate role in reducing litter, the slogan became a Texas cultural phenomenon and Texans have adopted and popularised the slogan; it appears on tourist souvenirs, similar to the "Keep Calm and Carry On" slogan.

Some of the programs initiatives include:

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[4] http://dontmesswithtexas.org/

- Adopt-a-Highway program – "If you tend to follow your own road, why not put your name on it and make it official? All you have to do is adopt a section of Texas roadside and clean it up four to six times a year"[5]

- Campus Clean-ups – universities and schools

- Road Tours - summer road tours are held which feature fun litter-prevention activities and events in communities across the state

- Trash-Off - the state's largest single-day clean-up activity

- Giving out free litterbags

- Phone apps to "report litterers" - This phone app gives Texans a way to actively report litter and litterbugs who are messing with Texas roadways. Users open the app, tap the type of littering they observed, and use the optional voice recording function to record to the offender's license plate and vehicle information.[6]

Appendix C

Some of the earliest behavioural research done on litter was in the Woodland Park Zoo in Seattle, WA, USA. This zoo is free admission zoo, and at the patrons included people from a wide variety of ages and socioeconomic backgrounds. The central issue that concerned the researchers was the amount of litter on the ground around the zoo. They decided to use a simple reward system to increase the amount of litter that was picked up by zoo patrons: For every ten patrons that threw away litter, they handed out a coupon tor a free drink at a local convenience stand.

It was found that:

- The number of pieces of litter picked up during two week-long periods when the reward system was not in place were 723 and 2403.

- The number of pieces of litter picked up during two week-long periods when the reward system was in place were 4577 and 6032.

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[5] http://www.dot.state.tx.us/trv/aah/
[6] http://dontmesswithtexas.org/report-a-litterer/app/

- After unexpectedly high response rates, the researchers had to switch from every ten patrons to every twenty patrons, due to the excessive number of free drinks that were being given away.
- Using this approach, there appeared to be less litter at any given point during the day. This compared with conventional approaches, where the environment is immediately free of litter after a litter crew cleans, and then gradually accumulates litter until the crew returns.
- Cost-efficiency was not reported in this study.

The use of a behavioural intervention can greatly increase the amount of litter picked up in an area using basic reward techniques. However, the practicality of this is questionable for large areas that are less governed, and the cost-efficiency compared to that of a cleaning crew is unknown at this point.

Appendix D

In Germany, customers pay a deposit for drinking bottles/cans and get their money back when they return the empty bottle in the supermarket. Glass bottles for most beer and beer-mixed drinks (usually up to 0.5 litres) are worth €0.08. Reusable glass and plastic bottles for most soft drinks (usually up to 2 litres) are worth €0.15. Reusable glass bottles of a special kind and design (usually flip-top bottles for beer) are worth between €0.15 and €0.50.

This example is not particular to Germany alone, although they offer a good example of the best practice litter-reduction regulations that allow for refunds on drink containers. This means glass and plastic bottles, cans and tetrapaks all become worth something.

Particularly in larger cities, the recognition of the worth of these bottles has led to both a tidier city and interesting social results. One anecdote describes, a group of young people in Berlin at 2am, who were seen stacking their bottles neatly around

the base of a bin so that the homeless people could collect them and claim the refunds.

The biggest problem with the deposit-refund system is that the deposit is often far too small for most people to want to take the trouble of returning the bottle or other product. If the consumer receives too low an amount for the bottle, it will not be worth the time or effort to return it.

Appendix E

Singapore, Litter-Free[7]

Singapore is a city well-known for its punitive system for dealing with litter, but it also has a very creative community-based program to encourage Singaporeans to keep Singapore Litter-Free.

In 2002, the National Environment Agency (NEA) unveiled their new anti-littering initiative - the 'Singapore, Litter-Free' campaign. The initiative works with event organisers, parks, petrol kiosks, primary schools, hawker centres, coffee shops and bus stations to discourage littering.

One of the educational events organised was a photography competition, with the theme 'free the city from litter'.

Here are some of the entries:

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[7] http://app2.nea.gov.sg/singapore_free_campaign.aspx

At this year's Singapore National Day Parade, the "Singapore Litter-Free" campaign launched their 'Bag It to Win It' contest.

Litter bags were provided in the fun packs given to event attendees as a quick and convenient way for participants to bag their litter after the show. The 'Bag It to Win it' contest encouraged people to bag their litter in plastic litterbags that were labelled with serial numbers and then drop them off at collection points outside the stadium. Each entry (via a litter bag serial number) had a chance to win up to 100 cash vouchers worth $150 each if their bags were drawn.

Appendix F

A research-based evaluation compared a 'marked litter' intervention method and employing individuals to pick up litter. This study was carried out in a residential facility for individuals with learning difficulties.

- The 'marked litter' method consisted of randomly marked pieces of litter (marked with spray only visible under black light) purposefully placed with other litter. When this marked litter was collected and turned in, the individual who had picked it up was rewarded monetarily and with social praise (hanging a picture of the individual on the "Winner" bulletin board).

- The employed individuals were paid an hourly wage, for one hour per day, to pick up litter.

When marked items were used, a decrease in the number of litter pieces in the area was noted. The employed individuals decreased the amount of litter, in comparison to the 'marked litter' method, but by only 3%. The 'marked litter' scheme was almost identical to the cost of employing people to litter-pick.

These findings are consistent with the history of variable schedule reinforcement found in behavioural science. When a good event follows behaviour intermittently and not on every occasion, that behaviour will reoccur at high rates in order to access the next good event (as in *Figure 1*).
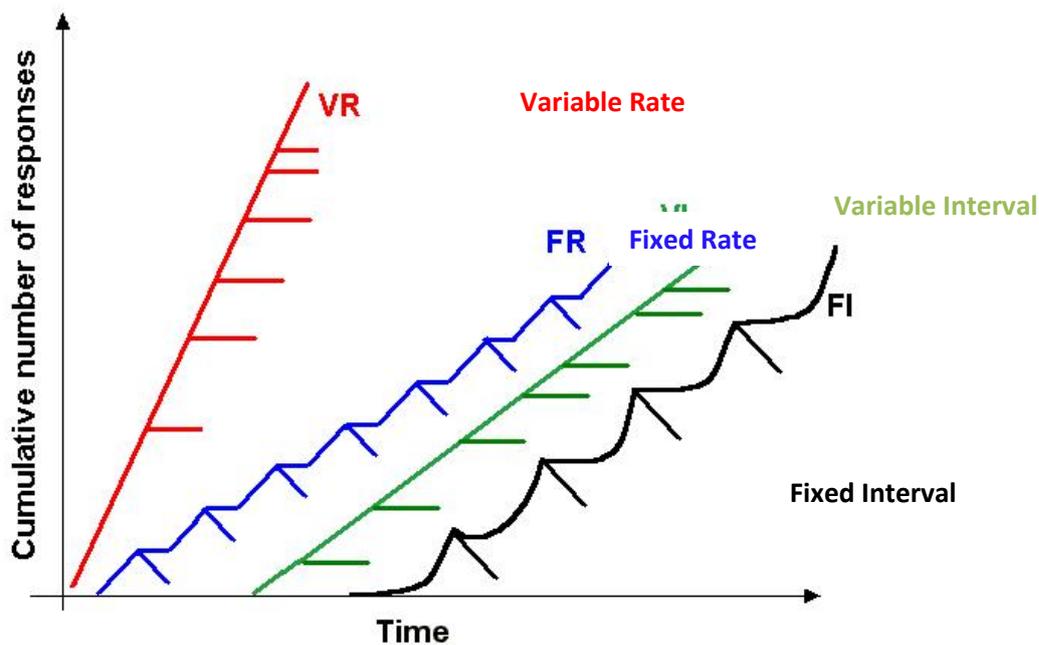

Figure 1

Appendix G

Keep Sweden Tidy[8]

Keep Sweden Tidy encourages people to pick up litter in order to achieve a cleaner environment but also to show how many people actually care. Two of the components of the program are:

- During the spring months of March, April and May, National Litter-Picking Days are arranged.
- Social contingencies are leveraged by having specific days where, if people do not join in with these events, they feel as though they are not participating/conforming with the group.

Since Sweden already had a large force designated to cleaning up litter, it is difficult to get an accurate estimate of how helpful these interventions are.

Appendix H

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8   http://www.keepswedentidy.org/sa/node.asp?node=2736

The Teignbridge District Council used a campaign of shared responsibility with the public[9]. In particular, they wanted to use positive imagery and support the existing work of the waste management division at the Council. The tagline "Tidy Teignbridge" works both as a statement of intent and as a call to action for tourists and residents. The Council gave the campaign a human face, using a real street cleaner named Malcolm.

The Behaviour

Teignbridge Council persuaded local businesses selling takeaway food to sign up to a Voluntary Code of Practice. Signatories participated in a selection of activities: displaying campaign material, reducing the packaging of products and the number of bags given to customers, litter-picking the area outside their stores, and improving their waste management by storing waste correctly and signing up to recycling collections. Any business taking part was given a formal certificate of recognition by the Council.

The Council also increased their cleaning and enforcement patrols activities around fast-food outlets in local towns and issued £75 fines to people caught dropping litter.

An event was organised for a team of thirty-three street cleansing operatives to showcase how many bags of litter had been collected from the towns and beaches in Dawlish, Dawlish Warren, Teignmouth and Newton Abbot in just one week. The mountain of bags was displayed on the seafront at Teignmouth. Residents and holidaymakers alike were shocked to see how much litter was collected over such a short space of time.

Appendix I

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[9] http://www.powermarketing.co.uk/caseStudy/Anti-littering+campaign/

In 2008 and 2009, Paris City Council succeeded in lowering the quantity of waste in Paris, by launching a pilot operation of waste reduction in the Popincourt Bastille and Nation-Alexandre Dumas wards[10]. For the first time in France, action awareness and experimentation of new eco-responsible consumption practices is being conducted on a large scale, involving 60,000 people in the two pilot districts. This operation is called "Moins de Déchets Dans le 11ème, C'est Possible", translating as "Less Waste in the 11th District: It Is Possible".

Interventions included:

- Introducing three types of bins for door to door collection – white lid for glass, yellow lid for recyclables and a green lid for other waste.
- Organizing exhibitions of rubbish.
- Naming people as 'ambassadors' for the cleaner wards.
- Putting accessible software on the District website that allowed people to identify which bin to use for which package.
- A monthly solidarity clothing collection and swap was organised.
- Kitchen "Anti-waste" workshops were held to teach how to make food from leftovers.

Punitive approach

A punitive campaign was also launched in Paris at the same time, with the tagline translating to "Paris Fines Litterers." The fine is €35 (currently approximately £30) and applies to dog excrement not being picked up, urinating in public and dropping litter.

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[10] http://www.mairie11.paris.fr/mairie11/jsp/site/Portal.jsp?page_id=1340

The figures

A lot of work is done on a daily basis to keep the streets of Paris clean.

- More than 2,900km of sidewalks are scanned every day for litter.

- 30,000 wastebaskets (one bin every 100m) are distributed on public roads, and emptied at least once and up to six times per day.

- 1,500 miles of streets are sucked and washed at least once a week.

- Routes heavily used are cleaned at night, by sections, in order to interfere with the least possible traffic.

- The cleaning services must adapt to seasonal considerations. In autumn, they pick up the dead leaves and in winter identify if there is snow on parts of the pavement, prioritising access to nurseries, schools, hospitals, pedestrian crossings, and the Metro.

- Paris has twenty daily open markets, which produce considerable volumes of waste and packaging. Teams operate from the closure of the markets to clear waste and washing of places.

- 400 free and self-cleaning 'superloos' are available to the users of public space.

- There are 166 accessible public toilets in parks and gardens in Paris.

- 26,062 fines were issued in 2010 for cleanliness offences.

- €35 is the amount of the fine for any violation of the regulations (article R 632-1 of the penal code: fine of 2nd category).

- €1500 is the amount of the fine incurred for bulky or rubble deposits made by private vehicle (art R 635-8 of the penal code).

Appendix J

Christchurch, New Zealand – The City That Shines

New Zealand English curriculum schools have introduced an education package for students in years 9 and 10. The City That Shines[11] is a classroom-ready teacher resource for students aged 13 and 14. It is designed to make students more aware that the litter problem in Christchurch, on the streets and in waterways, is everyone's problem. The resource provides activities that look at formal and creative writing, close reading, research and presenting. The All About Litter fact sheet supports students and teachers studying the 'City That Shines' resource.

A number of Christchurch schools also participate in community organised clean-ups, where a day will be organised and a particular spot targeted. All the litter collected will then be sorted, and returned to the manufacturers from which the product originally came, accompanied by a letter asking what the producer intends to do about the littering of their product. This is known as "extended producer responsibility" and is becoming an increasingly popular angle to address littering.

Appendix K

The Wiltshire Wildlife Trust (WWT) has launched a national campaign in the United Kingdom designed to help schools through each stage of their '6 Step' litter

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[11] http://www.ccc.govt.nz/learning/educationforsustainability/waste/citythatshines.aspx

campaign[12].

Step One: Inspiring students. Some of the essential facts and figures about litter are shocking and can provoke a strong reaction.

Step Two: Finding the source of the problem. In some schools the source of a litter problem will be easy to identify. A tidy school at the start of the day is often strewn with crisp packets straight after lunch break.

Step Three: Brainstorming ideas. Once the most likely causes of litter in the school have been determined, discuss with the pupils their ideas for tackling it. Help them to think creatively and be ambitious. Try to come up with a long-term plan that will not only clear up the litter immediately, but help to change attitudes so that littering becomes unacceptable.

Step Four: Putting it into practice. Most litter campaigns will take place over a defined period of time such as a whole term or a specific week, so set clear targets and objectives at the start.

Step Five: Measuring success. Evaluating the success of a project is invaluable. It ensures that the pupils and staff feel a real sense of achievement at the end of the project. It's essential that an evaluation is part of the planning right from the start

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[12] http://www.wiltshirewildlife.org/who-we-are/welcome-to-wiltshire-wildlife-trust

and not simply tagged on at the end.

Step six: Encouraging lasting change. The key part of any litter campaign is to keep the momentum going long-term.

Appendix L

Volunteer Workers

Several interventions in the past have used children to decrease the amount of litter in given areas. A research project was completed in a forest campground in the Wenatchee National Forest, WA, USA[13], and in a high-density urban area, Kansas City, Kansas, USA[14]. In each of these studies children were offered a reward to dispose of litter. By posing the task as both an educational opportunity and a game that offered prizes, the experimenters in the campground got support from parents and children alike. In Kansas City, researchers concentrated on how children would respond to being paid for different metrics (e.g. weight, volume, clean areas). It was found that:

- Employing children work may raise ethical questions, but for children wishing to work, this job requires minimal effort.

- The cost payment by volume was the condition that rendered the most litter and the greatest number of children participating. However, it left many smaller items uncollected, as the children would leave smaller items that were not worth as much money.

- The cost-efficiency of cleaning an area was very high: for a someone to employ a group of children to clean gardens in an urban area in the United States, it can cost as little as $1 per unit per month.

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[13] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1310718/pdf/jaba00067-0003.pdf

[14] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1311983/pdf/jaba00061-0023.pdf

There are groups that will clean up litter for relatively low costs. Clubs for children (e.g. Scouting and Guiding groups) often do this type of work as a learning opportunity. Making rewards contingent on the group cleaning an area frequently could maintain the cleanliness for a relatively low cost. Labour sources like this might be considered when looking for efficient interventions.

Appendix M

A study was designed to increase participation in a kerbside recycling program sponsored by a city in the United States[15]. Citizens who consistently recycled were asked to be "recycling block leaders".

- Block leaders were instructed to give approximately 10 of their non-recycling neighbours a persuasive talk regarding recycling as well as handing them special recycling bags.

- The second experimental group had the same speech and recycling bags left at their door.

The results indicated that:

- The group that had the information and bags left at their door recycled significantly more than the control group that received no treatment.

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[15] http://www.tandfonline.com/doi/abs/10.1080/00909889209365317

- The experimental group that had block leaders recycled significantly more than either the other experimental group or the control group.

A neighbourhood leader program is something that would mostly be implemented by community members. It is possible that the behaviour on the part of the neighbourhood leader might be difficult to maintain. This could be countered by introducing consequences for that person finds reinforcing, such as recognition for being a neighbourhood leader, or a monetary reward, either to the leader or to charity.

Cigarette Butt Campaigns

Appendix N

Victoria Litter Alliance - 'Bin Your Butts' campaign:

The Victorian Litter Alliance and Sustainability Victoria also worked on a successful cigarette litter campaign called 'Don't be a Tosser – Bin Your Butts.'[16] Cigarette butts represent 56% of Victoria's litter stream, so the long-term goal of the campaign was to help meet Victoria's 'Towards Zero Waste' litter target of a 25% reduction in littering behaviour by 2014.

There were two primary objectives against which behavioural outcomes were evaluated. They were:

1. To have at least 20% of licensed premises be model adopters by the peak of the campaign, demonstrating high levels of participation and support for the butt litter prevention campaign through active implementation of recommended actions accompanying the introduction of the legislation.
2. To prevent an increase in cigarette butt littering by smokers at model adopter locations by the peak of the campaign, with their target littering rate being under 50%, with a stretch target of 40%. That is to say, after the campaign smokers will be much less likely to litter and more likely to use bins to dispose of butts.

This campaign achieved its goals of changing smoker behaviours to reduce butt litter. Prior to 1 July, 2007, 40% of smokers were binning their butts. By campaign peak this had increased to 66%, with two thirds of smokers binning their butts.

There were many contributing factors that led to smokers changing their behaviour and binning their butts. However, the four most critical change enablers, as identified through the evaluation of the 'Don't be a Tosser – Bin Your Butts'

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[16] 'Don't be a Tosser - Bin Your Butts' butt litter campaign evaluation, Sustainability Victoria available from http://www.sustainability.vic.gov.au/resources/documents/LIT_Final_Evaluation.pdf

campaign, can be categorised as partnerships, place, promotion and personal action:

- **Partnerships** – Strong strategic alliances with the hospitality industry, local governments and state government to facilitate an integrated collective approach.
- **Place** – Venues acting on the campaign's messages and providing facilities for smokers to bin their butts (providing bins, having staff regularly patrol and clean up butt litter, having signage asking smokers to bin their butts).
- **Promotion** – Supporting promotion, mainstream advertising and media publicity that raised awareness of butt litter generally.
- **Personal action** – Smokers going to the effort to bin their butts and not feeling ostracised or 'blamed' through the campaign.

Appendix O

Keep America Beautiful – Cigarette litter reduction

Keep America Beautiful (KAB)[17] is a U.S. based not-for-profit organisation founded in 1953. Keep America Beautiful focuses on three key issues: litter prevention, waste reduction/recycling and community greening & beautification.

The 2011 the Ocean Conservancy International Coastal Cleanup identified cigarette butts as the number one most littered item, representing 32 per cent of all debris counted. KAB's 2009 "Litter in America" research found the overall littering rate for cigarette butts was 65 per cent, with tobacco products comprising 38 per cent of all U.S. roadway litter.

KAB implemented a specific Cigarette Litter Prevention Program (CLPP) during 2011 and have subsequently reported an average of 54 per cent reduction of cigarette litter in the communities.

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[17] http://www.kab.org/

The program consists of a community participation ownership aspect (forming teams, researching local litter laws and educating the community), reporting in a tangible way the impact of their actions, and designing encouraging solutions such as pocket ashtrays/receptacles.

The installation of ash/cigarette receptacles at transition points (places where smokers must stop smoking before proceeding) were also successful at changing behaviour. A partnership with Boat U.S. Foundation showed that, on average, marinas that participated in the CLPP in 2011 saw a 50 percent decrease in cigarette litter at their marina. Nearly half of the participating marinas saw substantial reductions of 70 percent or greater. The Executive Director of Loup Basin stated that, "after all of the receptacles were installed, and the pocket ashtrays and car receptacles were handed out, the number of butts and cigarette trash around Lake Ericson was reduced by 75 percent."

KAB have set up a "self-service" type website where resources to enable a community to join in with their litter prevention program, at http://preventcigarettelitter.org/ are available.

Unusual Approaches

Appendix P

The World's Deepest Bin - http://www.thefuntheory.com/worlds-deepest-bin

The aim of The Fun Theory was to get more people to throw rubbish into the bin, rather than onto the ground, by making it fun to do. The results were hugely successful – during one day 72kgs of litter were collected in the Fun Theory bin. This was 41kg more than a normal bin. The video in the link above demonstrates how this was done.

The Bottle Bank Arcade - http://www.thefuntheory.com/bottle-bank-arcade-machine

The Fun Theory also created a bottle bank which reinforced the behaviour of recycling bottles. Their solution turned a chore into a fun game. Their bottle bank arcade was used by nearly 100 people in one night compared with just 2 people at a nearby traditional bottle bank. The video in the link again shows how this was done.

The Kaleidoscope Bin design – people enjoyed using them, resulting in more litter being collected.

http://tinyurl.com/bo6bgxv.